AMERICAN ENGINEER

"THE RAILWAY MECHANICAL MONTHLY"

(Including the Railway Age Gazette "Shop Edition.")

PUBLISHED ON THE FIRST THURSDAY OF EVERY MONTH, BY THE
SIMMONS-BOARDMAN PUBLISHING COMPANY,
83 FULTON STREET, NEW YORK, N. Y.

CHICAGO: Plymouth Bldg. CLEVELAND: Citizen's Bldg.
LONDON: Queen Anne's Chambers, Westminster.

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Subscriptions, including the eight daily editions of the *Railway Age Gazette* published in June in connection with the annual conventions of the Master Car Builders' and American Railway Master Mechanics' associations, payable in advance and postage free:

United States, Canada and Mexico	$2.00 a year
Foreign Countries (excepting daily editions)	3.00 a year
Single Copy	20 cents

Entered at the Post Office at New York, N. Y., as mail matter of the second class.

VOLUME 86. MAY, 1912. NUMBER 5.

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M. M. and M. C. B. June Conventions

The delightfully informal character of the entertainment features at the Atlantic City conventions, as outlined in the News Section, will undoubtedly be appreciated by the railway men and others who are looking forward to attending the conventions. With the substitution of the informal, but none the less enjoyable, features in place of the very formal affairs of previous years, it is hoped that more of the members will bring their wives and families with them. The way in which the cost of the entertainment features is to be divided among the three associations will obviate any possible criticism as to the railway members being entertained at the expense of the supply men.

The Safety Competition

The rapid developments in the safety campaign on the different railways during the past few months have created a widespread interest in this subject, and we hope that our readers will participate freely in the safety competition to close June 1, which was announced in our April issue. A most important part of the campaign must necessarily be to induce the employees to make proper use of the safeguards and to see that they are maintained in good condition and are not abused. A prize of $25 will be awarded for the best article descriptive of safety devices which have been installed in railway shops, engine houses or repair yards, or of methods which may be used to awaken the employees to a full realization of their part in the safety campaigns. Articles not awarded a prize but accepted for publication will be paid for at our regular space rates.

Mounting Air Brake Hose

The *Railway Age Gazette* recently drew attention to the large percentage of air brake hose that fails, due to the puncture of the inner tube when forcing on the nipple by machine. The statement is made that some of the roads have discontinued the use of machines for this purpose and are having the work done by hand. A number of air operated machines for mounting air hose have been described in the *Railway Age Gazette* Shop Section at various times since the shop kink competitions were inaugurated. They can handle this class of work so much more rapidly than it can be done by hand that it would seem advisable to make a special effort to perfect such of the devices as may not have proved satisfactory, rather than to discard them entirely. The problem seems to be almost entirely one of keeping the hose and the nipple in proper alinement during the operation and this ought not to prove an insurmountable difficulty.

The Convention Season

The month of May will open the season for railway mechanical conventions. The Air Brake Association will hold its annual meeting at Richmond, Va., May 7-10, and the Master Boiler Makers' Association will meet at Pittsburgh, Pa., May 14-17. Two other conventions of associations which are closely allied to the mechanical department will also be held during the month. The Railway Storekeepers' Association will meet at Buffalo, N. Y., May 20-22, and the International Railway Fuel Association will meet in Chicago, May 22-25. Announcements of the principal subjects which will be discussed at each of these conventions will be found in the News Section. Three mechanical department associations will meet during June, all of them at Atlantic City, N. J. The Association of Railway Electrical Engineers will hold its semi-annual meeting June 11; the Master Car Builders' Association will meet June 12-14, and the American Railway Master Mechanics' Association, June 17-19. Two conventions will be held in Chicago

during July; the American Railway Tool Foremen's Association will meet July 9-11, and the International Railway General Foremen's Association, July 23-26. Both of the August conventions will also be held in Chicago. The International Railroad Master Blacksmiths' Association meets on August 15, and the Traveling Engineers' Association later in the month. The Master Car & Locomotive Painters' Association will hold its annual meeting at Denver, Colo., September 10-13.

Steel Suburban Cars

For high speed suburban service with comparatively frequent stops the dead weight of the rolling stock becomes an important factor, even more so than on steam operated trains where recent experience indicates that this feature of steel passenger car design will have to be given more serious consideration. On an electric suburban line of the character of the New York, Westchester & Boston, the provisions for safety and comfort approach those of steam railway operation, and the cars which have been designed for this service include features of construction which, possibly in a somewhat altered form, are worthy of consideration for heavier equipment. When a 70 ft. car seating 88 passengers, and of the evident strength of those on the Westchester, can be designed to weigh something under 90,000 lbs. (estimated to weigh 80,000 lbs.), its construction is worthy of careful study. The so-called "unit" side framing is a novelty, and of course is largely responsible for the success in weight saving. While these pressed shapes might be somewhat difficult to manufacture and handle for a larger car the ideas suggested by their use indicate a line of investigation which might result in a considerable saving in the weight of some of our present exceptionally heavy steel passenger cars.

Engine House and Shop Foremen

Many lessons may be learned about the proper condition of a locomotive leaving the shop by following it to the engine house. Engine house foremen almost universally severely, and in many cases justly, criticise the condition of locomotives which they receive after repairs have been made in the shop. This is generally, of course, aimed at small things, but it is just these small things which make so much difference in the engine house and which the shop so easily overlooks. On one road, noted for the efficiency of its organization, it has been found advisable to frequently promote engine house foremen of considerable experience to the shop staff, so that there will always be one or two thoroughly experienced engine house men among the shop officers. If the engine house foremen have had the proper amount of shop training previously, as should always be the case, they come back to the shop with a broader and more desirable viewpoint of locomotive repairs and the output of their shops will probably be much more free from criticism from the engine house viewpoint. Too frequently the shop and the engine house do not work in harmony, and a judicious interchange of officers of the two departments will very largely correct a trouble which in some cases is really serious.

Burlington 2-10-2 Type Locomotive

The five locomotives of the 2-10-2 type recently delivered to the Chicago, Burlington & Quincy by the Baldwin Locomotive Works, illustrated elsewhere in this issue, are of particular interest as marking the continued development of the simple non-articulated type permitted by the use of high degree superheated steam. These locomotives are very large and in fact seem to practically set the limit of weight for the non-articulated engine except in cases where wheel loads greater than 60,000 lbs. per axle are permitted. They are designed for a service which many people consider suited to the articulated type, and their performance will be watched with much interest. There are two features which will probably be questioned in the minds of many motive power men in examining this design. One is the effect of this length of rigid wheel base and heavy wheel loads, not on the main tracks, but in the yards, and second, the advisability of putting this amount of power through two main crank pins, the latter being not so much on account of the direct pressure on the pins as the general effect of the necessarily heavy rods and counterbalancing. These features have evidently both been fully appreciated by the designers, and steps taken to properly care for them, but it will take actual service to positively settle the question. These locomotives are so large as to practically compel the use of an automatic stoker, if coal is to be burned, and the Barnum type of underfeed stoker which has been developed on the Burlington has been applied.

Writing for Technical Journals

One of the advantages of writing articles for technical papers is indicated by an incident which took place recently. In our March issue, page 123, Lewis D. Freeman described a 100-ton hydraulic press which could be utilized for light work by using two 14-in. auxiliary air cylinders in place of the hydraulic cylinders. A reader, noticing that the air pipes were so arranged that the air cylinders received air at the top only, and were therefore apparently used for pulling down or relieving the lower dies, suggested that Mr. Freeman's article was incorrect. We wrote to Mr. Freeman and here is his reply:

> The air cylinders of the 100-ton hydraulic press as first designed were only used, as you state, to relieve the dies, but when writing the article I found that it would be an advantage to use the air independently for light work and to that end I am going to have the press so altered. However, I neglected to state in the article that air should be used on the top end of the cylinders to pull down the lower die, as the hydraulic pistons are packed so tight that the weight of the lower die is not always sufficient to lower the die.

In preparing an article for publication and explaining why certain things are done, or just how an operation is performed, weaknesses in the design are often developed, or possible improvements are suggested. The weakness of an argument often becomes apparent when the attempt is made to reduce it to writing. For these reasons the practice of writing for the technical papers develops and broadens a man in a way that it would be difficult to do otherwise.

Superheaters on Switch Engines

It has been quite generally considered that switching engines do not present an opportunity of obtaining any economy through the medium of superheated steam, but actual experience has shown that quite the contrary is the case. On one road two switching locomotives were equipped with Schmidt superheaters and put in service at a passenger terminal. The results have been a most pleasing surprise. The saving obtained in coal and water on a percentage basis is considerably greater than in the case of the road engines, and the power and quick response of the locomotive has been noticeably improved. There is also a considerable reduction in the smoke. It is somewhat difficult to explain the reason for these results, but it appears probable that because of the large proportion of time in which a switch engine is shut off, the cylinders cool down to so low a degree that the condensation of the saturated steam is very large. The amount of water frequently thrown from the stack is striking evidence of this. There is also considerable water drawn over through the dry pipe in many instances. The superheated steam largely overcomes this while, at the same time, the locomotives do not operate a sufficient distance to cause the loss which the full stroke would normally give with superheated steam. The throttle is not generally closed long enough at any one time to permit the superheater pipes to cool down enough to cause condensation in them, and while the temperature of the

steam at the cylinder is probably not as large as would be obtained after continuous service, it is still superheated sufficiently to, at least, greatly reduce the condensation loss. Whatever the explanation may be, the fact remains that a decided saving is obtained on these locomotives, not only in coal and water directly, but in the time lost in going after fresh supplies and by the more lively work performed. After looking carefully into the subject one large switching company has recently ordered superheaters for fifteen engines now being built.

Engine House Problems

The engine house is usually the critical point in the operation of a division, and as suggested by Mr. Cordeal, in an article elsewhere in this issue, it is more in need of systematic and effective organization than almost any other department. The wide variation in the size of engine houses and the conditions, even on one division, are such that it is difficult to outline an ideal scheme of organization which can be applied to all of them, and yet it must be admitted, after reading Mr. Cordeal's article, that he has been most successful in outlining an organization of this sort, which, in its general principles, may be universally applied. The trouble with many engine house organizations is that they are "one man" affairs and the foreman has to carry too much of the detail and wear out entirely too much shoe leather. With the organization suggested, and the records which are proposed, the foreman is enabled to take a broad view of the situation and direct his forces to the best possible advantage. Moreover, he will always be in a position to quickly and accurately advise his superiors as to the exact condition of the motive power and when it will be ready for service. The article on Engine House Organization in this issue, is the first of a series of three articles by the same author on engine house problems. The second article on Engine House Reports and Records will make definite recommendations as to exactly what records and reports should be kept to get the most efficient results. The third article will cover engine house facilities, taking up the question of the proper equipment for engine houses of various sizes. For instance traveling cranes, drop pits, jacks, machine equipment, tool rooms and special tools, boiler washing systems, and other small items will be considered, the present or absence of which influences the economic handling of engine houses to a greater or less extent.

Poor Box Car Construction

The *Railway Age Gazette* is publishing a series of articles on defective box cars and damaged freight, which promises to bring about important practical results in improving box car construction. Probably as much as $10,000,000 a year is paid out by the railways of this country in settling freight claims for damage caused by defective equipment. A very large proportion of this is due to door fixtures which permit the cars to be pilfered from without breaking the seal, to poorly constructed sides and ends which permit grain and similar products to leak out, to side doors and roofs which allow moisture, dirt and cinders to enter and damage the freight, and to weak ends which allow the loads to shift and damage both the lading and the car. L. H. Turner, superintendent of motive power of the Pittsburgh & Lake Erie, in a letter to the *Railway Age Gazette*, said: "Our company pays out a large amount annually for loss and damage to freight, and I am free to say that 95 per cent. of the damage might be avoided by better loading of the freight in the cars, more careful handling of the cars by the trainmen and better constructed cars, which will not leak at the doors or the roof." That this condition exists is undoubtedly due to the fact that those in charge of drawing up the specifications for and purchasing the cars do not understand the seriousness of the situation. The defects are being described in detail in the *Gazette*, and remedies are suggested in each case. Because of the interchangeability of the freight cars the recommendation is also made that the American Railway Association form a bureau whose duty it shall be to pass on new cars which are built, or on all cars which receive heavy repairs, and see that they are properly constructed from the standpoint of damage to the freight.

Locomotive Costs on a Ton-Mile Basis

On most roads the locomotive maintenance costs are based on locomotive mileage, and it is to the direct interest of the master mechanic, as well as other motive power officers, to have the tonnage per train at a minimum, and thus be able to present better unit cost figures. The division superintendent, on the contrary, is interested in obtaining a maximum tonnage, and thus two of the most important officers on a railway are working at cross purposes when there should be the greatest possible co-operation in their efforts. When on the engine mile basis, the master mechanic naturally makes every effort to have the tonnage rating of a locomotive reduced after it has made a reasonable mileage. Furthermore, the tendency will be to keep the locomotives out of the shop just as long as possible and to do as little work as possible on them at the engine house, attempting to force the superintendent to continue to operate them at reduced tonnage. This is not the best method for the railway, and the motive power officers should not be tempted to direct their efforts in this direction by a method of accounting. If, on the other hand, the cost of locomotive repairs is placed on the basis of ton-miles, the master mechanic and superintendent are working for the same ends, and the tendency will be for the master mechanic and all other motive power officers to direct their efforts toward keeping every locomotive on the road in 100 per cent. condition just as long as possible and to take it into the shop just as soon as it proves impracticable for the engine house to further maintain it at full hauling capacity. The master mechanic immediately becomes vitally interested in the ton-miles handled per hour on his division, and will use all the influence possible to see that full tonnage trains are operated at the highest practicable speed, and this of course produces the best net results for the company. The ton-mile costs also permit of very accurate information as to whether money should be put into new locomotives or into new shops to best increase the strength of the department.

Convention Suggestions

The average railway mechanical department association could make its work far more effective if the officers had a better understanding of their duties and spent more time in preparation for the conventions. The following suggestions, which are based on an observation of six of these conventions last year, may not be amiss. In some instances the president, and even the secretary of the association, arrived on the ground only a few hours before the convention was opened and the work of getting things into shape for the opening was left largely and almost entirely in the hands of the supply association. The officers seemed to have no clear idea when the convention was opened as to just how the meetings should be conducted, or what was to be accomplished, and an air of uncertainty hung over the first sessions of several of the conventions.

The officers should be on hand a day or two before the convention opens, and every move, not only for the opening session, but for the entire convention, should be carefully planned. Moreover, every association should start all of its meetings on the advertised time. It is pathetic to watch the officers hang around waiting for people to come into the convention hall when, if they actually got up on the platform and started the proceedings, the members would be only too glad to come in

and take their places. A little more decision and push on the part of the presiding officers would make some of the conventions from 25 to 100 per cent. more effective than they are now. The president has an entire year in which to prepare himself, and yet it is not unusual to find men holding this position who do not understand even the rudiments of parliamentary law. They are lost when it comes to stating or putting motions, and in spite of the fact that they are accustomed when working in the shop to make themselves heard above the noise of the machinery and pneumatic riveters, they seem to be afraid of their voices in the convention hall; in some cases it is difficult for even those in the front rows to understand what they are driving at. It is no easy matter oftentimes to conduct and direct the work of a convention, and those who are chosen for this work should realize that considerable study and preparation are necessary on their part in order to be able to perform their duties satisfactorily.

Another common abuse is that of having the committee reports read by the secretary or one of the officers, who has not had or has not taken time to look them over previously. Last year in several instances the whole import and value of reports was lost because the men who wrote them, and who were present at the meetings, would not or were not allowed to present them. The officers who were asked to read them could not read the writing freely, or it was expressed in terms which were foreign to them, and the effect of the reading was discouraging and practically spoiled the entire value and usefulness of the report. Committee chairmen should be notified that they are expected to present the reports, or if for any reason they cannot do so, it is up to them to have one of their committee members, who is properly qualified, do it for them. If no member of the committee can be present, or if an individual paper is prepared whose author cannot attend the convention, it should be forwarded to the officers of the association in plenty of time so that the one who is selected to read it can study it over carefully and be in a position to read it freely and intelligently.

In providing for the use of a hall or room in which to hold the convention, arrangements should be made so that all noise which may interfere with the proceedings will be eliminated while the meetings are in progress. Very few halls are satisfactory for the holding of railway conventions, and in some cases where satisfactory ones are provided the exhibitors or hotel attendants are not properly impressed with the idea that they must not under any circumstances make noises which will disturb the meeting. Last year at three of the conventions the exhibitors were responsible for creating noises and disturbances which seriously interfered with the progress of the meetings.

NEW BOOKS

The Mechanical World Pocket Diary and Year Book for 1912. Emmott & Co., Manchester, England. Cloth, 4 in. x 6 in., 263 pages. Price, 12 cents.

The twenty-fifth annual edition of this publication appears promptly, and with some improvement over previous issues. The section on steam turbines has been rewritten and extended considerably, with new illustrations. There are new sections dealing with roller bearings, helical springs and milling cutters, and a number of new tables. The book is more fully illustrated than formerly, and the whole work has been subject to a thorough revision.

Addresses to Engineering Students. Edited by Wadell & Harrington, consulting engineers. 480 pages, 6 in. x 9½ in. Bound in cloth. Published by Wadell & Harrington, Kansas City, Mo. Price $1.

It is not infrequent that some of the very best thoughts and expressions of our foremost engineers and professors are contained in addresses delivered to student associations or classes. Even when such addresses are published they are usually given such restricted circulation that their possible value is greatly reduced. Recognizing the importance of many of these addresses, Wadell & Harrington, consulting engineers, Kansas City, Mo., have collected material of this kind, so far as it was available, and have compiled it into a single volume. This has been done without thought of any pecuniary reward, and the book is being issued at cost price. Many of the addresses given are prefaced with editorial notes, telling who the writer was and for what special purpose the address was prepared. While this collection is intended largely for engineering students, particularly freshmen, it will also be found of interest to engineers in general, particularly those interested in educational work.

Proceedings of the Nineteenth Annual Convention of the International Blacksmiths' Association, held at Toledo, Ohio, August 15-17, 1911. 242 pages. Cloth. Illustrated. Published by the association, A. L. Woodworth, secretary, Lima, Ohio. Price, $1.

The work of this association steadily improves in its quality and scope. Reports of the committees, while generally brief, were supplemented by excellent contributions from various members, and by the clearing up of debatable points during the discussion. The volume contains papers and reports on the following subjects: Drop forgings; frogs and crossings; special welding and threading steel; oxy-acetylene welding; tools and formers; properties of iron and steel in connection with their chemical composition; piece work; effect of heat and working on metals; the foreman and his men; flue welding; frame making and repairing; case hardening; spring making and repairs, and high speed steel. The proceedings also contain a list of members and the membership of the various committees which will report at the next convention.

Accident Prevention and Relief. By Ferd. C. Schwedtman and James A. Emery. 481 pages, 6 in. x 9 in., illustrated. Bound in half leather. Published by the National Association of Manufacturers, 30 Church street, New York.

The authors of this work were sent abroad by the National Association of Manufacturers to study and report on the prevailing systems for the compensation for and prevention of accidents in various foreign countries. They visited England, France, Germany, Austria, Hungary, Belgium, Switzerland and Italy, and at each place were given the fullest opportunity of making their investigation complete. The report deals especially with the systems in use in England and Germany, which were found to be the most advanced, and covers legislation, insurance, safety museums and societies, statistics, employers' liability, etc. Colored plates and charts are used very freely and the whole work of the authors and the associated committee is boiled down into very positive, clear-cut recommendations for action in this country. This book is beyond doubt the most business like and real practical publication available on this subject.

Prevention of Railroad Accidents. By Geo. Bradshaw. Published by Norman W. Henley Publishing Company, 132 Nassau street, New York. Bound in paper, 4½ in. x 6½ in. 173 pages. Illustrated. Price, 50 cents.

Possibly influenced by the activities of the Industrial Safety Association there seems to have been a recent revival of organized effort to prevent personal accidents in all departments of railways. Some of the companies are going to the extent of employing specialists in this line, whose efforts are producing most gratifying results. The author of this work, Mr. Bradshaw, has been employed on the New York Central & Hudson River for this purpose, and for a number of years has been constantly engaged in a study of railway accidents. The human element is the most important factor of the subject and he has therefore found it necessary to accomplish his results largely by the use of lectures and pamphlets. This book is composed principally of material prepared for this purpose, and is very thoroughly illustrated. In it are discussed accidents in all the different departments of a railway; the section devoted to shops is by no means the least important.

ENGINE HOUSE ORGANIZATION AND OPERATION

An Ideal, Practical and Simple Form of Organization Is Outlined, Which May Be Applied to Any Size Engine House.

BY ERNEST CORDEAL,

Acting Bonus Supervisor, Atchison, Topeka and Santa Fe, La Junta, Colo.

It is doubtful whether there is any one department on a railway which, while lending itself readily to effective organization and the production of satisfactory results by reason of systematic organization, is so greatly handicapped by its absence as the engine house. By reason of the complexity of the work to be handled and the importance of its being performed with the greatest possible expedition the necessity for an efficient, comprehensive, flexible organization is greater than in other departments. The efficiency of the engine house depends on its ability to handle and repair power in the least possible time consistent with the maximum quality of locomotive performance, and at the minimum expense. Engine house efficiency may be computed from the performance of locomotives handled on the basis of five definite items: (1) Cost of repairs; (2), cost of handling; (3), mileage between failures; (4), mileage between shoppings; (5), time of detention.

Only after the determination of the efficiency of each of these items can an equitable conclusion be reached as to the effectiveness of the organization. Low costs represent efficiency only in so far as they are correlated with a high standard of performance and low average time of detention.

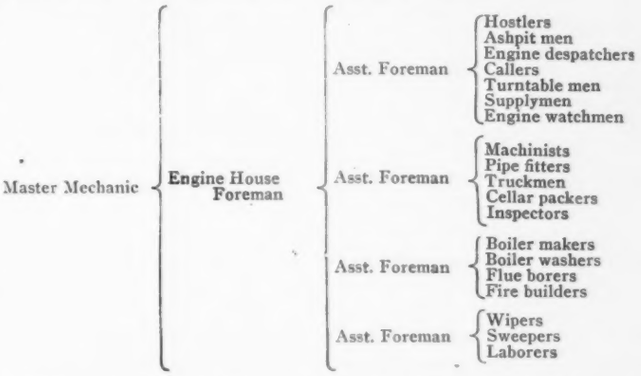
High efficiency of performance as represented by large mileage between failures and between shoppings is the end chiefly to be desired, but there is no reason why such results should not be accomplished in conjunction with reasonable costs. The ends, therefore, which the engine house organization is expected to attain, are minimum costs of handling and repairs, elimination of engine failures, prolongation of periods between necessary shoppings, and minimization of time out of service due to repairs and handling. In order to accomplish these ends all movements of the locomotive from the time of its arrival at the engine house tracks until the time of its departure must be the subject of the most careful supervision.

It is to be feared that as a general rule the organization of engine house forces is of a very primitive form. The engine house foreman is often burdened with too much detail work to enable him to perfect and supervise a suitable organization, the result being an overworked man in charge of an inefficient force with a resultant poor locomotive performance and high cost. Again, the supervising force may be too large, giving each member an insufficient amount of work. Such a case will also result in inefficiency, owing to the high cost of supervision and general bad results emulating from the conflicting instructions which are bound to obtain in organizations where authority is divided between too many individuals.

There are four distinct classes of work in connection with the handling of locomotives: handling, machinery repairs, boiler repairs, and cleaning, and any organization to be effective should recognize these distinctions. The form of organization which is shown on the accompanying diagram should produce the highest possible efficiency.

To produce the best results the master mechanic should in no way interfere with the engine house foreman as far as the actual supervision of the department is concerned. All instructions which he may see fit to issue, all criticisms or suggestions which it is necessary or expedient to make, should be communicated directly to the engine house foreman, and never to assistant foremen or individual workmen. In this way only can the most effective organization be perfected and maintained.

Every time that a master mechanic or higher officer takes upon himself the duty of supervising details in an engine house he weakens his organization; he reduces the respect in which the authority of the foreman is held by his subordinates; he produces a complication in the handling of the work by creating a certain amount of uncertainty as to who is responsible for results, and in addition he wastes valuable time which should be spent in a study of division conditions as a whole.



The engine house foreman should be supreme in his own province. He should be directly responsible to the master mechanic for the results obtained and should not be embarrassed by interference in the exercise of his exclusive supervision over the engine house as long as the efficiency of operation is satisfactory. If the proper results are not forthcoming, it is a clear indication that the wrong man has been selected for the place and he should be superseded by another man possessing the necessary qualifications.

What has been said of the master mechanic in his relation to the engine house foreman applies equally to the foreman in relation to his assistants. Each assistant, fitted by training for his particular position, should be responsible alone to the engine house foreman, and in turn the men under his supervision should report and receive their instructions directly from him. No workman should be under the supervision of two foremen at the same time, and no foreman should be required to look to more than one higher officer for his instructions.

As to the specific duties of each member of the suggested organization. The lines between the fields of responsibility should be clearly drawn and no foreman should be allowed to overstep those bounds by issuing instructions to men other than those directly assigned to his care. The engine house foreman should keep in close touch with the transportation department, so as to be informed at all times of the class of power that will be required and the time at which it must be delivered. He should, by a system of reports, understand fully at all times the power conditions at his station, so as to be able to furnish exact information as to what power is available for service. He should direct the movement of all locomotives while in his charge by issuing definite instructions to his assistants as to what work incoming locomotives will require, what time they should be set in the house, what time the repairs must be completed, and what time the engine must be fired and ready for service.

The assistant foreman in charge of hostlers should be responsible for the expeditious handling of power from the time

it arrives at the engine house tracks until it is turned over to the repair foreman, and should again resume authority as soon as repairs have been completed and the fire built. His prime object should be to see that no delays are incurred in knocking fires and supplying fuel, sand and water so that the maximum amount of time may be available for necessary repairs. When resuming charge of locomotives on which repairs have been completed, it is his duty to see that they are properly supplied for the coming trip and that they are in readiness at the appointed time.

The assistant foreman in charge of the mechanics should be responsible for the workmanship and despatch with which repairs to machinery are completed. He should be the judge as to the necessity for repairs reported by enginemen or inspectors, and on him should rest the responsibility for failures of power due to machinery parts.

The assistant foreman in charge of boiler makers, in addition to the supervision of boiler and firebox repairs, should also be entrusted with the washing of boilers and the building of fires. He should receive full information as to when engines are required for service so as to be able to have fires lighted at the last possible moment consistent with a fair margin of safety, in this way effecting fuel economy by not retaining engines under fire for long periods in advance of the time required.

The fourth assistant might properly be termed a labor boss, and the nature of his duties would hardly class him with the other assistant foremen. However, he should not be subordinatd to any of the other assistants, but should report directly to the engine house foreman, thereby eliminating any possibility of a conflict of authority. His duties comprehend the cleaning of engines in such time and manner as not to interfere with the work of mechanics or boiler makers, the keeping of the engine house and adjacent yard clean and free from accumulations of scrap or rubbish and the furnishing of labor to handle material or assist in heavy repairs.

The suggested organization is a flexible one in that the principals evolved may be applied to engine houses of any class, regardless of the size of the force employed, by making minor changes in the duties of the assistant foremen or by adding additional sub-foremen where the force becomes too large to permit the four assistants to exercise sufficiently detailed control. In a small engine house where locomotives are merely turned, and the necessary minor repairs made to insure their arrival at the main division point, the assistant foremen should be simply working bosses, bearing the responsibility for the work performed in their particular division, and at the same time performing a part of the actual work. The first assistant foreman then becomes in intent a head hostler, the second a head machinist, the third a head boiler maker, and the fourth a head laborer. This arrangement should not in any way effect the form of organization, the duties and authority of each individual remaining the same in fact and only varying in degree. It may be that at points where a very small force is employed the engine house foreman will be able, without conflicting with his particular duties, to assume the responsibility of one or more of the assistant foremen.

At very large points where the volume of business to be handled precludes the possibility of the four assistants exercising the required amount of control over the force, sub-foremen, either working or otherwise, should be appointed with specific duties and report directly to the assistant foreman at the head of their department. A very good plan for the manipulation of a large force is to divide the workmen into small groups, each group being in charge of a working boss. The work of each group should be as nearly as possible on the same class of work and within as small a space radius as practical. It may be found advantageous to divide the machinists into two separate groups, one to take care of passenger and the other freight power, placing at the head of each gang a sub-foreman or working boss who reports to the assistant foreman in charge of machine repairs. It will seldom if ever be found necessary to supply sub-foremen to the departments under the first, third, and fourth assistant foremen as the force necessary under these divisions should not exceed that which can easily be handled by one man. However, in special cases where the number of engines handled in twenty-four hours is very large, it may be found advisable to provide the assistant foreman in charge of handling engines with a working boss at the ash pit or with a head hostler. The assistant in charge of boiler work at points where this work is heavy may require a boss boiler washer, or even one or more working boiler maker bosses. The principal need for additional supervision, however, will be found in the department handling machinery repairs.

The first efforts of the assistant foreman in charge of repairs should be directed toward a definite and logical placing of his force so as to attain the best possible results. The work should be specialized as much as possible; that is, certain men chosen for adaptness in a certain class of work should be assigned to that work, and only in case of absolute necessity should they be taken off for other jobs.

Specialization may be carried out to the extreme in a large engine house. There, after a careful study of the average amount of work to be handled, a certain gang of men may be permanently assigned to rod work, guides and pistons, drop pit, steam pipes, etc. By keeping these gangs at a minimum as to the number of men it should always be possible to keep each group on its own class of work. They, being thoroughly conversant with the work and having always at hand the special tools required, should be able to maintain a high efficiency of output, together with the best quality of workmanship. It must be taken into consideration of course that there is a more or less great variation in the proportions of each class of work which will be necessary on different days, but this difficulty may be easily overcome at large points by the employment of a floating gang. This gang should be composed of good all-around mechanics who are able to do any or all of the various classes of work and who will be available at all times for use on the class which at the time happens to be heavier than can be handled by the regularly assigned gang. At most engine houses a greater or less number of engines are given light shoppings and very effective use can be made of a floating gang by working them on shop engines while running repair work is not sufficiently heavy to require their helping out the regular gangs. The smaller engine houses will experience considerably more difficulty in specializing the work, yet it can be done to a certain extent and the greatest possible limit of such organization will net the best results.

One of the principal, if not the paramount advantage of the suggested form of organization is that it provides a means of speedily and satisfactorily filling any vacancy which may occur in any of the supervising positions. In case of the engine house foreman leaving the service, his place can immediately be filled by the promotion of the assistant foreman who has proved the most efficient, his place in turn being filled by the best working boss in that department. In the case of a temporary absence from duty of any foreman no confusion would arise, as the next man in line would simply assume charge for the time being.

Such a form of organization, entailing as it does a regular line of promotion open to any workman who is able to demonstrate his ability, will tend to promote efficient performance on the part of the entire force. Each workman will strive to attain a record which will insure his selection as a working boss. Each working boss will aspire to an assistant foreman's position, and each assistant will endeavor by the excellence of his work to obtain the next vacancy as engine house foreman.

Another point which must be given consideration is that of rates of pay. Men work primarily for the remuneration which they receive. If the wage is satisfactory in the position which they occupy, their energies are bent toward the attainment of a record for good service which will entitle them to further ad-

vancement. If the wage is not commensurate with the amount of skill or ability required, the individual is principally interested in locating another position more to his liking, and consequently his service to the company is far less valuable than that of the satisfied man. The rates paid to working bosses or foremen should always be in excess of the wages earned by the workmen under their supervision. This is not always the case and that simple fact accounts in a large number of cases for the scarcity of competent supervision. It will be found an economic measure to provide salaries for assistant foremen sufficiently high to insure the retention of efficient men and the recompense of the engine house foreman should be considerably higher to act as an incentive for assistants to assume the added responsibility.

The organization of the engine house forces is an item of prime importance; it is not, however, the only point which requires attention. In order to obtain the best results from an efficient organization it must be furnished with brief, comprehensive and accurate reports and records and a method must be provided whereby comparison can be made between the relative efficiency of performance at various points and various periods. The engine house which handles its power with the minimum of failures and without causing terminal delays is very apt to assume a feeling of satisfaction overlooking entirely the fact that their excellent performance on these lines is not supported by an economic cost unit. In order then to keep before the various foremen the exact statis of their performance, comparative statements embracing the features of cost of repairs, cost of handling, mileage between failures, mileage between shoppings and time of detention should be compiled monthly and issued to the various members of the supervising force. In this way each foreman is provided with a means of comparing the efficiency of his performance with that of other foremen or with his own past records. Master mechanics have before them at all times records which will enable them to determine at a glance the ability, as expressed by results, of the various foremen under their supervision and the selection of men for promotion becomes a simple matter.

Engine houses are in the main inefficient, due in a great part to the necessity of subserving the efficiency of handling and repairing locomotives to the more important problem of conducting transportation. However, the presence of this necessity does not preclude the possibility of improvement in present methods with a view to increased efficiency of engine houses and the initial move in any such campaign should be the establishment of an effective form of organization, paralleled and supported by an efficient clerical force whose duty it is to maintain accurate and comprehensive records of current performance on which may be based reports and statements of permanent comparative value.

SHOP KINKS*

BY H. S. RAUCH

The following kinks have been used with very good results in the Oswego, N. Y., shops of the New York Central & Hudson River. They have been selected from several departments, including the machine shop, boiler shop and erecting shop.

DRIVING BOX SHOE AND WEDGE LINERS.

The device shown in Fig 1 is fastened between the flanges of a driving box and adjusted so that brass liners of the proper thickness may be cast on the shoe and wedge faces of the box. The

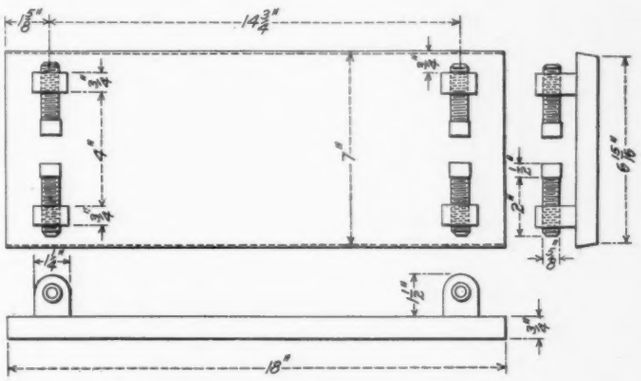


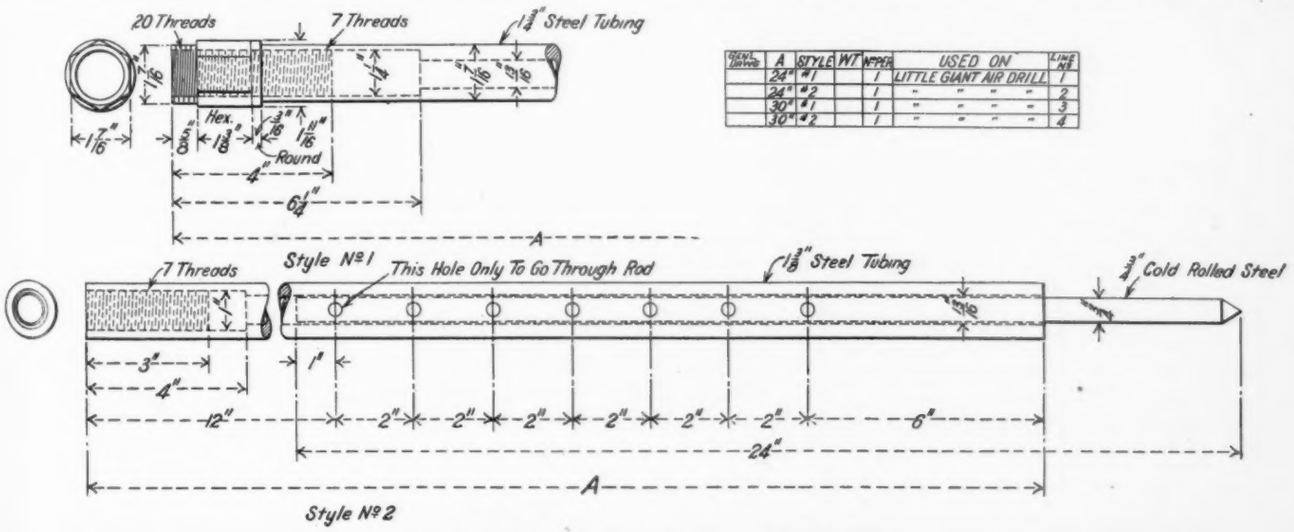
Fig. 1—Device for Casting Brass Liners on the Driving Box Shoe and Wedge Faces.

¾ in. plate is forged of wrought iron and the four lugs which carry the ⅝ in. set screws are welded to it.

EXTENSION BAR FOR AIR MOTOR.

The extension bar for supporting an air motor, which is shown in Fig. 2, is so simple that it hardly seems necessary to call attention to it. It is practically the same as the one used in the Chicago & North Western shops at Chicago, which was illustrated by a photograph in the issue of July 1, 1910, page 29. The length of the steel tubing, or the sleeve, is governed by the class of work on which the device is to be used. The ¾ in. cold wrought steel extension rod has a 5/16 in. hole drilled through it near its end and the steel tubing has similar holes drilled through it at intervals of 2 in. for the greater part of its length. One end of the tubing is threaded or arranged to fit the air drill

*These kinks were submitted in the *Railway Age Gazette* shop kink competition which closed April 15, 1911. Mr. Rauch was formerly apprentice instructor of the New York Central & Hudson River at Oswego, N. Y.



QUAN. ORDER	A	STYLE	WT	WEIGHT	USED ON	LINE NO
	24"	#1		1	LITTLE GIANT AIR DRILL	1
	24"	#2		1	" " " "	2
	30"	#1		1	" " " "	3
	30"	#2		1	" " " "	4

Fig. 2—Extension Bar for Supporting Air Motors.

with which it is to be used. The two types of ends shown are used for different styles of air drills.

DRILL TWISTING DEVICE.

The device shown in Fig. 3 is used for twisting flat bars of steel, which are made into drills by casting a brass shank on the end of the bar, anchoring it by drilling two or three small holes in the end of the flat bar before it is twisted. One end of the bar fits in the slot in the end of the spindle and the other end rests in the slot in the angle which is bolted to the end of the device. A number of these slotted angles are provided for the different sizes of drills. They can easily be changed by removing the ¾-in. bolt. The end of the flat bar is held rigidly in place by the clamp. After the brass shank has been cast on the twisted bar it is turned and ground to the proper taper, thus making a cheap and very serviceable drill.

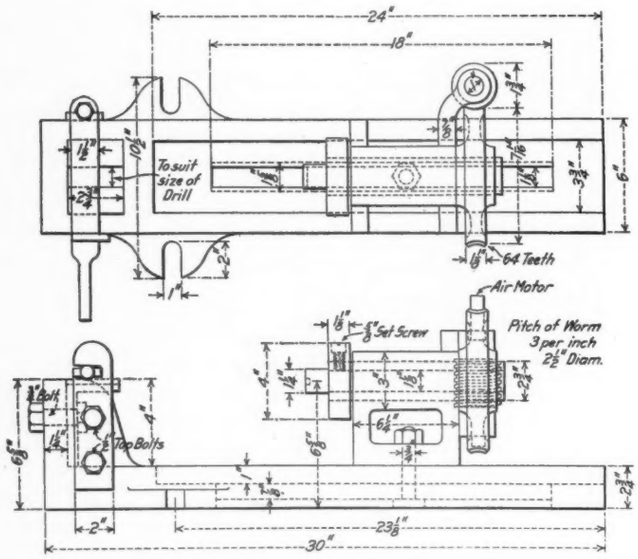


Fig. 3—Machine for Twisting Flat Drills.

Different lengths of bars may be twisted by adjusting the headstock on the base of the machine. It is only necessary to loosen the nut of the ¾ in. T-bolt, which holds it to the base. The spindle is also adjustable and is held in place in the revolving bearing by the ⅝ in. set screw and collar.

REBORING AIR PUMP GLANDS.

A device for accurately reboring air pump glands is shown in Fig. 4. The centering device, which fits in the head of the air pump cylinder, is fastened to the head by the cylinder head studs which fit in the ¾ in. slotted holes. It is made from an old air pump head which has been planed to a width of 4 in.

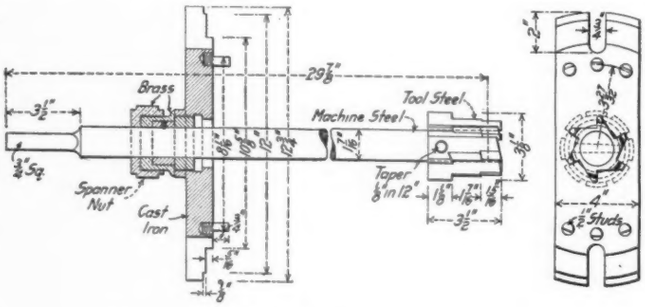


Fig. 4—Device for Reboring Air Pump Glands.

One-half inch studs are inserted in this centering piece, as shown, and they are then turned down to fit snugly into the pump cylinder. The cutter, which is made of tool steel, is fastened to the 1 7/16 in. arbor by a ¼ in. taper pin. Power for driving the device is furnished by an air motor.

PNEUMATIC HOLDER-ON.

An inexpensive holder-on for use in cramped quarters is shown in Fig. 5. These tools are made in several sizes to suit different classes of work. The steel box is threaded to take the head and the piston is of the type with leather packing, such as is ordinarily used in air cylinders. The piston is returned to its initial position when the air pressure is released by means of the coil spring. Compressed air enters underneath the piston through a ¼ in. pipe, the connection for which is shown in the cross sectional view of the device.

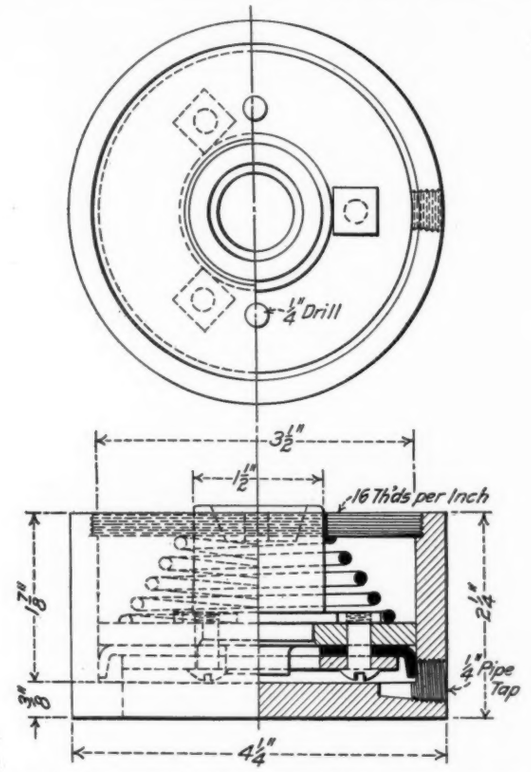


Fig. 5—Pneumatic Holder-on Used for Driving Rivets.

CLAMP FOR HANDLING SMOKESTACKS.

A convenient and safe clamp or sling for handling smoke stacks in the erecting shop is shown in Fig. 6. The two parts of the band are made from ½ in. x 1½ in. wrought iron bars. The hanger is made of 1 in. round iron with a 1½ in. eye in the center, in which the crane hook fits. The ends of the hanger are

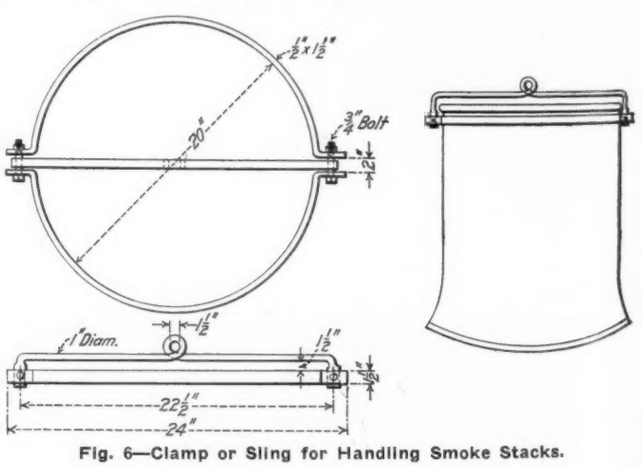


Fig. 6—Clamp or Sling for Handling Smoke Stacks.

upset and flattened and connect to the clamp by ¾ in. bolts, as shown.

FLUE HOLE CUTTER.

The flue hole cutter shown in Fig. 7 is used on a drill press and has a record of cutting sixty 2 in. holes per hour in ½ in. boiler plate, a Bickford radial drill being used. The shank is made of machine steel and has a socket, which is threaded to

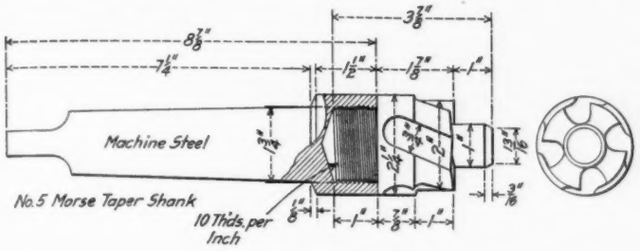


Fig. 7—Flue Hole Cutter.

receive the high speed steel cutter, as shown on the drawing. The cutter is guided and accurately centered by the 1 in. tit on the end, which fits in the 1 in. holes which have previously been drilled in the sheet. The bevel on the end of the tit assists it in entering the hole readily.

MOUNTING DRIVING WHEEL TIRES.

The device shown in Figs. 8 and 9 is convenient for handling driving wheel tires when mounting them on the wheel centers.

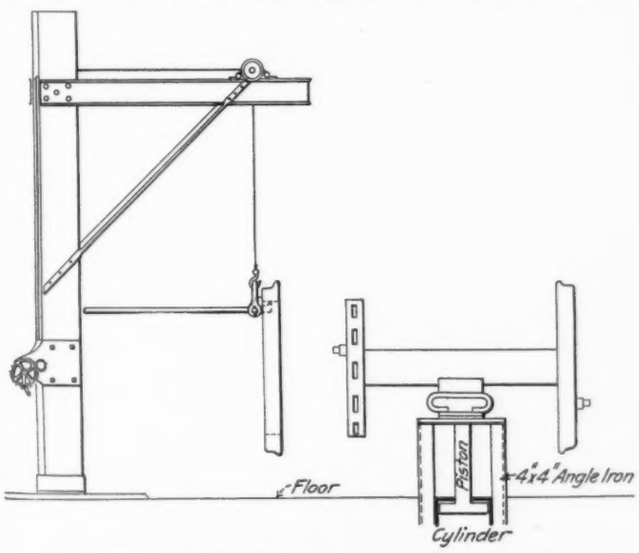


Fig. 8—Apparatus Used for Mounting Driving Wheel Tires

No chains are required, the tire being hung on the suspension point of the bar. In its normal position it holds the tire a little lower than the wheel center and the tire may, of course, be swung away from the wheel center while it is being heated. In applying the heated tire to the center it can be adjusted to the proper height by bearing down on the end of the long bar. The details of the device are clearly shown in Fig. 9.

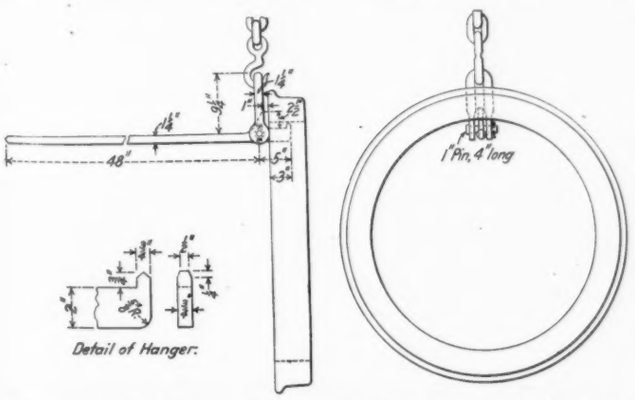


Fig. 9—Details of Hanger Used for Mounting Driving Wheel Tires.

DRILLING TELL-TALE HOLES.

A simple and effective jig for drilling tell-tale holes in staybolts is shown in Fig. 10. It not only insures the hole being central, but saves many times its cost in broken drills, where the ends of the staybolts are not sheared square or have more or less irregular ends. The jig was designed by W. F. Black, the apprentice shop instructor, and has eliminated all troubles due to the tell-tale holes being drilled off center. It is made of case hardened machine steel and slips over the end of the bolt, the 13/64 in. hole being used to guide the drill. This jig is made in several different sizes to suit the different diameters of staybolts.

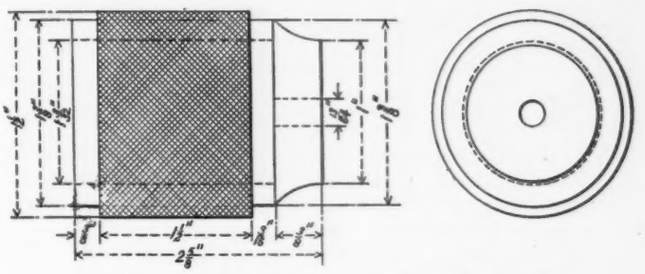


Fig. 10—Jig for Drilling Tell-Tale Holes in Staybolts.

PROTRACTOR FOR LOCATING ECCENTRIC KEYWAYS.

The protractor for locating eccentric keyways, which is shown in Fig. 11, is made of machine steel. The semi-circles which are cut on it represent the different sizes of axles that are used. The radial lines are cut one degree apart, as shown. In using the protractor lines are layed out on the axle corresponding with the centers of the crank pins. The dividers are then set to the required number of degrees and the center of the eccentric is laid off. Later a box square is used to strike the center line of the keyway. The weight of the protractor is reduced by cutting out the metal on the back, as shown.

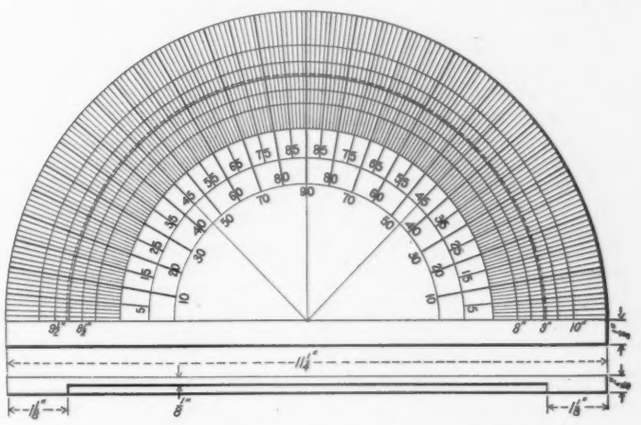


Fig. 11—Protractor for Locating Eccentric Keyways.

LARGEST FERRYBOAT.—The Southern Pacific is building at its Oakland shipyards the largest ferryboat in the world, to be run across the Carquinez Straits between Port Costa and Benicia, Cal. The new boat will be known as the Contra Costa, and will be 433 ft. 4 in. long, by 116 ft. wide, with a tonnage of 3,800 tons. The Southern Pacific already has in service at this strait what is called the largest car ferry in the world, the Solano, built in 1879. The new vessel is only a little larger than the Solano, which carries 48 cars, of the length prevailing in 1879.

DESIGN OF FORMERS FOR HYDRAULIC PRESS

Outline of Methods Employed in Connection with the 800-Ton Press Described in the April Issue of the American Engineer.

BY LEWIS D. FREEMAN.

The problem of designing formers for a large hydraulic press is so extensive that only the general principles can be given here, together with a few illustrations of the different kinds of formers used to obtain certain results. To begin with the designer must have a thorough knowledge of the action of the press and the forces exerted; he should study each particular press and tabulate all the necessary information before proceeding with the design of the formers. In the present case the formers will be designed for the flanging press described in the April issue of the *American Engineer,* page 201. This press has the following capacities:

	Capacity.	Stroke.
Top plunger	250 tons	36 in. downward
Vise plunger	200 tons	36 in. upward
Main platten	800 tons	48 in. upward
Jack plungers (4)	50 tons each	24 in. upward

Strength of Formers.—Formers are usually made of cast iron and sometimes steel plates are used to reinforce the surfaces that are subjected to the most wear. The ultimate strength of good cast iron is about 20,000 lbs. per sq. in, and a factor of safety of at least 10 should be allowed in all parts of formers subjected to tension and shearing stresses, thus providing a safe working stress of 2,000 lbs. per sq. in. The working stress in parts subjected to compression only may be as high as 10,000 lbs. per sq. in. The strength of the formers depends on the maximum pressure that can be applied by the press and not on the pressure necessary to press the shape in the formers, as the whole power of the press is always exerted on the formers regardless of the pressure required to form any particular shape.

Styles of Formers.—There are two general styles of formers used on the standard hydraulic presses; those that are composed of two parts, called the male and female, and those that have three parts made up of a male, female and clamping parts. The former style is desirable where the parts to be pressed are simple and have no large flat surfaces or deep flanges to be kept free from wrinkles. Good judgment must be used by the designer in selecting the style of former best suited to the shape under consideration.

Allowance for Shrinkage.—It must be remembered when designing formers that the sheets to be pressed are hot and the shapes must be made larger than called for on the finished drawing to allow for the contraction when the plates cool after pressing. The coefficient of this shrinkage has been found to be 0.0078; that is, any plate that is heated to a flanging heat will expand in all directions 0.0078 times the original size. To simplify the calculations the given or finished dimensions must be multiplied by 1.0078, which is the equivalent of multiplying the given dimension by 0.0078 and adding the result to the dimension itself.

Weight of Formers.—While there is such a thing as making the formers too heavy, no effort should be made to cut down the weight to such an extent that the fiber stress will run above the figures given. It would be poor economy to cut a few hundred pounds off the weight of a large former only to have it fail on the first trial, resulting in a loss many times the amount saved, as well as the inconvenience caused by holding up the work.

Careless Handling.—Many well designed formers have been broken or damaged by not having the sheets hot enough, and if sheets are not placed on the formers while they are at a bright red heat they should be returned to the furnace and another heat taken. Flanging the sheets when cold causes them to crack and show other defects, and should be avoided.

Designing Formers.—No fixed or set rules can be laid down for the design of all formers, as the conditions vary with each particular case under consideration, and depends on the shape of the work to be pressed, and the size and capacity of the press. A uniform section should be laid out for each particular press, and if it proves satisfactory, after a fair trial, it should always be used on that press wherever possible, thus saving a large amount of work when designing new formers. The formers should be made of as nearly uniform thickness as possible to reduce the shrinkage strains in the castings. The proper application of the principles involved can best be illustrated by some examples of modern practice.

Standard Sections.—It has been found by experiment that the sections shown in Fig. 1 are suitable for use on a press where the maximum pressure exerted is 800 tons. The first section is suitable for sheets up to ⅜ in. thick; the second section is

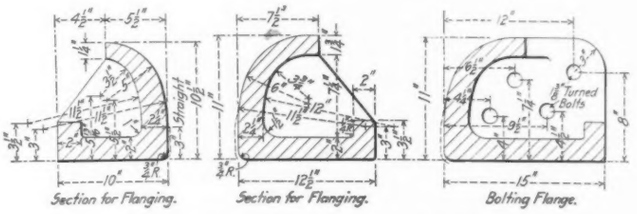


Fig. 1—Sections of Formers Suitable for 800-Ton Press.

suitable for sheets up to ⅞ in. thick, and for heavier sheets a still heavier section should be developed. Where it is necessary to cut the female former at several places, the operation is greatly simplified by using a standard bolting section, as shown in Fig. 1. All corners should be rounded and liberal fillets allowed; also ribs should be placed where they are needed to further strengthen the different parts of the formers.

Ash Pan Wheel Pocket Formers.—It is often desired to press the ash pan wheel cover for the locomotive ash pan. Such a cover is shown in Fig. 2, and it will be seen that a three piece former must be used to insure smooth and flat flanges. The style of former is shown in Fig. 3. The press operator must manipu-

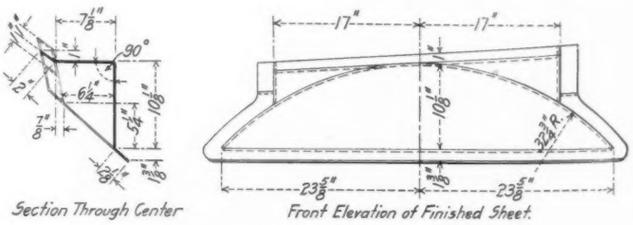


Fig. 2—Locomotive Ash Pan Wheel Cover.

late the press in such a manner as to allow the sheet to draw through between the female and clamping former, while the male former is forced through by the vise plunger on the press. It is impractical to attempt to finish such formers on a machine and the patterns must fit together to insure the formers being true when cast. The casting is usually done in dry sand which is rather slow. Some expert molders are now making such formers in green sand with good results. The pattern shop work may be greatly simplified by making the male former first and covering its working surfaces with old leather belting, which

is of the same thickness as the metal to be pressed. Then get the shape of the female former by building a box around the male former and pouring in plaster of paris, allowing it to harden. This method is satisfactory, and only a fraction of the labor is involved compared to when the pattern is made wholly of wood.

Circular Boiler Tube Sheets.—Fig. 4 represents a design of former for circular boiler tube sheets; this former is of the three piece type. It will be noted that the female former is composed of four sections; this is done to reduce the pattern work and the difficulty of handling so large a former through the shops. Only one section of the pattern need be built, and should the former ever fail, only one section will need to be replaced.

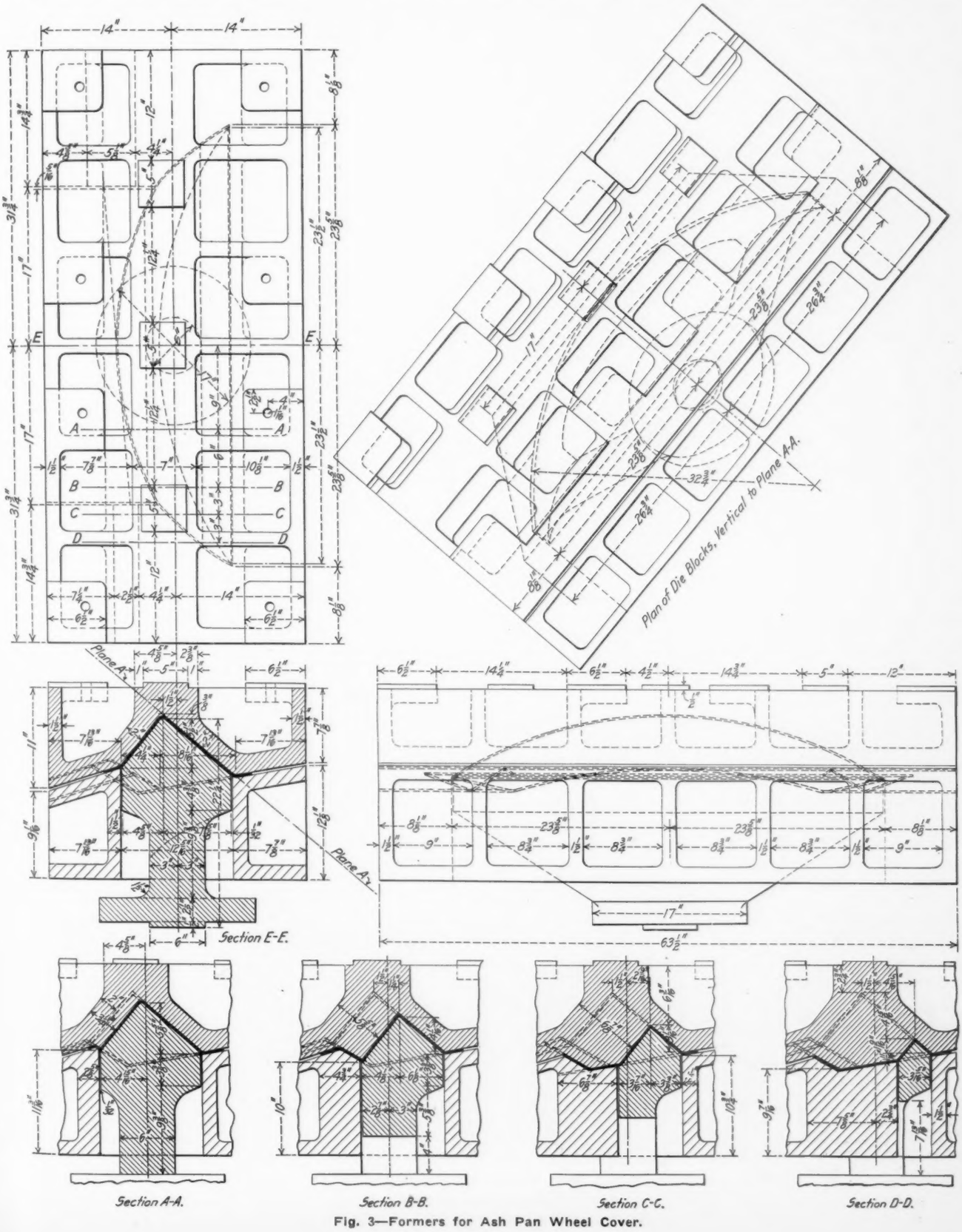


Fig. 3—Formers for Ash Pan Wheel Cover.

In locomotive building plants it is customary to make many formers in sections so that liners may be applied to make different sizes, as the one size may never be used again. However, when liners are placed in circular formers they are distorted from the true circular form and the sheets pressed on such formers are usually found to give trouble after they have been placed in service. In railway shops it is more desirable to bolt up a set of formers for a particular class of locomotive, and as they will be used as long as the locomotives are in service it will pay to leave them bolted up ready for use on short notice. It will be an advantage to make use of the same patterns for making different sizes of formers where this can be done by adding extra finish to the smaller size patterns. Several different sizes can also be made by machining down old formers. In this way the work in the drawing office may be greatly reduced and formers of the same general design may be indicated on one drawing by making a table containing the various dimensions. To insure a careful fit of the heads in the boiler the former should be laid out as follows: Determine the correct diameter of the inside of the boiler at the flue sheet, and multiply this dimension by 1.0078, which will give the diameter of the flue sheet; now take 1/16 in. from the diameter to allow the head to be 3/16 in. smaller in circumference than the inside of the boiler; the result will give the diameter of the female former and it will be found that the flue sheet will be a neat fit in the boiler. To find the diameter of the male die subtract twice the thickness of the metal to be pressed plus 1/16 in. from the female former for clearance between the sheet and the former at all points. This will govern the exact outside size of the flue sheet.

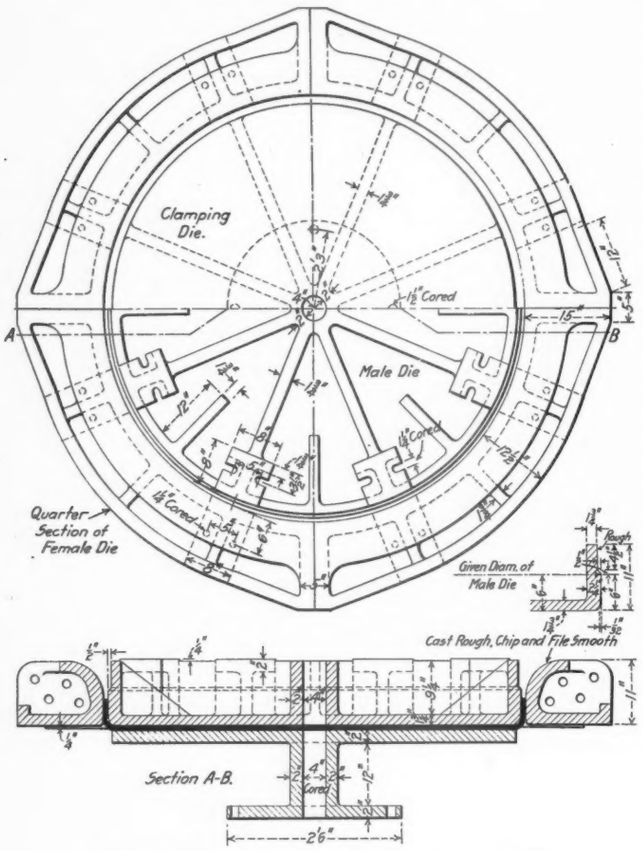


Fig. 4—Formers for Pressing Boiler Tube Sheets.

Offset Firebox Sheets.—Another example of locomotive formers is shown in Fig. 5; this style of former is necessary to turn a 6 in. flange up all around the sheet. Lugs are cast on the clamping former in order to locate the sheet so that the proper amount of material may be left below the bend; after this operation the female former is brought into action, turning up the flange around the sheet. Until a short time ago the practice was to have the female former follow the contour of the sheet so that the flange would be turned up all around at the same time. With the advent of the offset sheet, however, it was found that when using this method the surplus metal was forced to the bend near the middle, with the result that the sheet was doubled over on itself and sometimes tore out the corner when the large amount of metal refused to pass through the formers at this

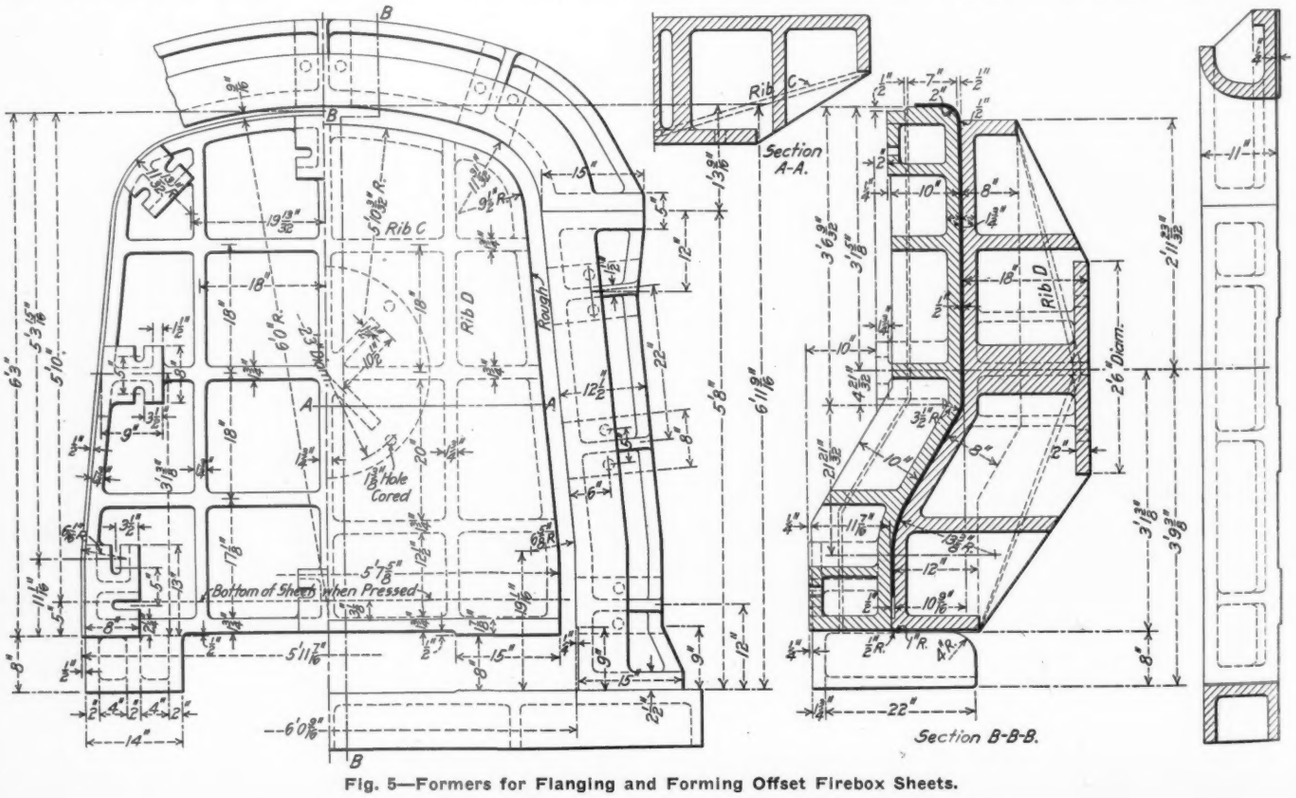


Fig. 5—Formers for Flanging and Forming Offset Firebox Sheets.

point. To overcome this difficulty the writer developed the straight line female former shown in Fig. 5, which will turn up the flange on the lowest part of the sheet first and allow the surplus metal to turn up along the ogee and escape at the highest point of the sheet which is pressed last, leaving a smooth and perfect flange. Guides are provided to hold the clamping former and the male former together when pressing the offset in the sheet before flanging, as well as to form a guide for the female former and take the reaction against the crosstie in the back of the former when pressing the sheet.

Former Supports.—The designer must be well acquainted with the manner in which the formers must be supported to properly take the strains of flanging the sheets. A set of standard supports, such as shown in Fig. 6 should be made in various lengths. The first one will be found to be very economical, as the pads for the supports on the formers may be made to suit the standard supports. A sufficient number of these supports should be kept on hand so that various combinations will be available. In all cases before sending the formers to the shops for use the blue prints should be marked with the proper length and style of supports to suit the strokes of the press under consideration. This matter should not be left for the shops to do, as it will delay the work.

Formers for Steel Cars.—An example of a steel car former used on this large press is shown in Fig. 7. It is intended to make two different lengths of side stakes for bracing the sides of steel hopper cars with high sides. This is a two piece former which is entirely suitable for such work. For making the longer stake a block is applied to the lower former, as indicated in the drawing, and to make the shorter stake it is removed and another block is applied to the top former. In this way the shorter stake may be made on the same general former used for the longer one. Dowels are located on the lower former, so that the sheets may be centered quickly and not lose too much of

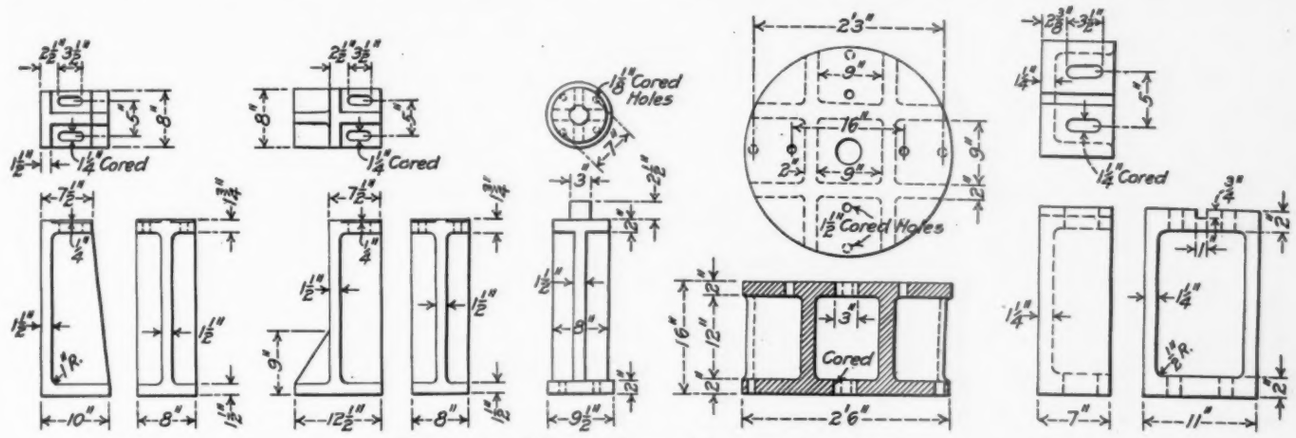


Fig. 6—Five Different Types of Supports for Formers.

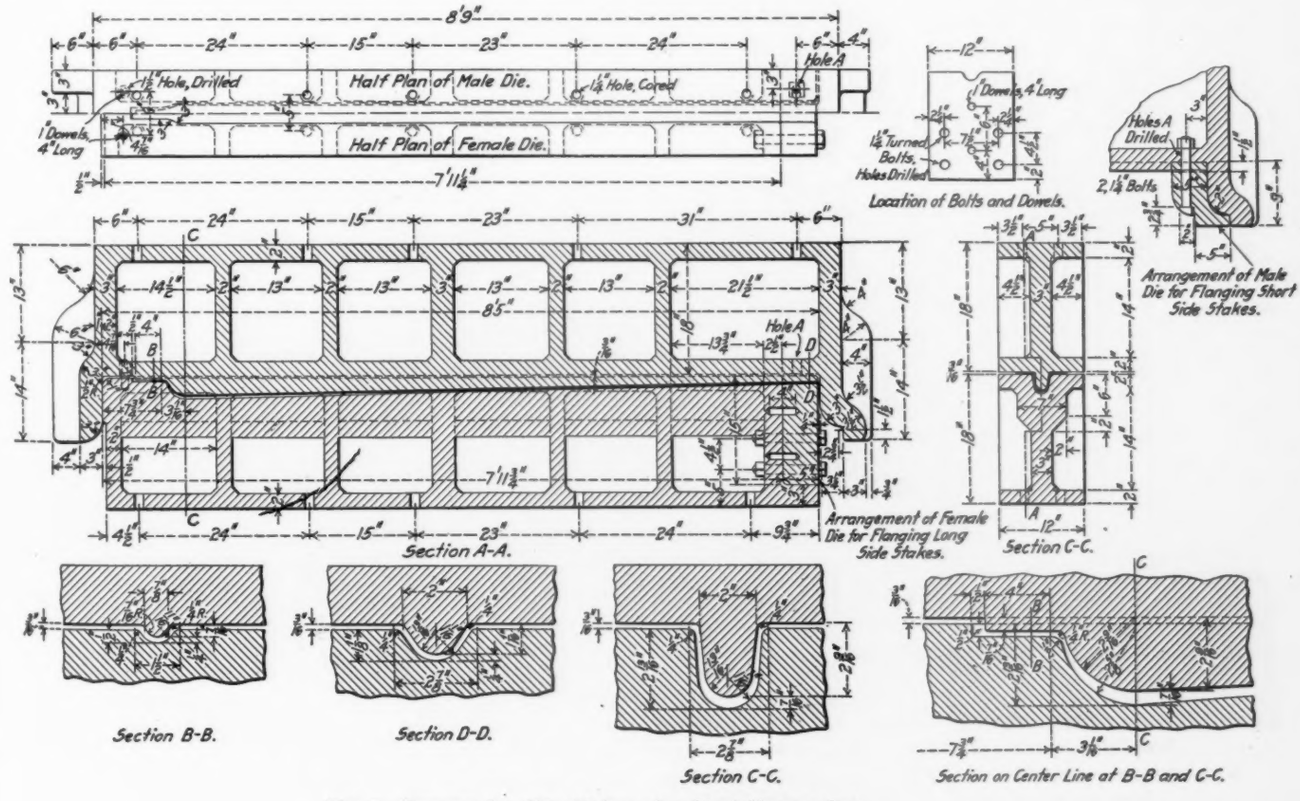

Half Plan of Male Die.
Half Plan of Female Die.
1" Hole, Drilled
1¼" Hole, Cored
Hole A
1" Dowels, 4" Long
Location of Bolts and Dowels.
Holes A Drilled
2, 1¼" Bolts
Arrangement of Male Die for Flanging Short Side Stakes.
Arrangement of Female Die for Flanging Long Side Stakes.
Section A-A.
Section C-C.
Section B-B.
Section D-D.
Section C-C.
Section on Center Line at B-B and C-C.

Fig. 7—Formers for Side Stakes of a Steel Hopper Car.

their heat. Great care must be exercised to provide the proper clearance in such places as at section *C-C* Fig. 6, so that the sheets may have sufficient clearance. The strongest kind of formers could be broken if this was not done, as the tongue on the former acts as the wedge, which with a load of 800 tons on the formers would certainly break something. Such formers when used on a large press should be set up in pairs so as to make two parts at one operation of the press, saving 50 per cent. of the power required to do the work separately.

Steel Freight Car Doors.—A three part former for pressing steel freight car doors is shown in Fig. 8. The operation of this former is the same as other three part formers already described. The lugs cast on to center the sheet are so arranged that both right and left hand doors may be made on the same former by

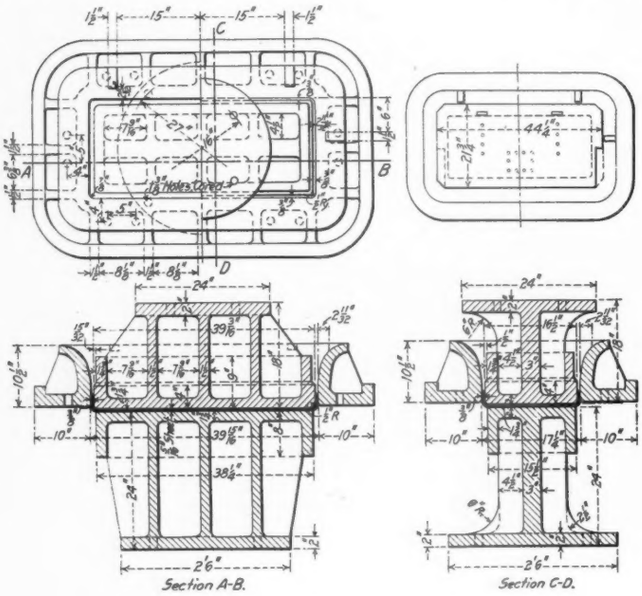


Fig. 8—Formers for Pressing Steel Doors.

reversing the blank sheet before pressing. In such simple work it is advisable to cut all holes and slots with a template while the plate is flat, as the work can be done much quicker than after the parts are pressed.

The Size of Stock Required.—The size of the blank stock required to form a certain piece should be estimated very closely by developing the sheet to some convenient scale and checking such development, so that the amount of material ordered may be kept down as low as possible. There is very little stretch in pressing sheets which are more than ⅛ in. thick, and no allowance should therefore be made for stretch. The formers should be so designed that the sheets will not be stretched and their thickness reduced. Very thin sheets have been known to stretch as much as 20 per cent., and the blank sheets could be made that much smaller, so as to finish to the required size. This cannot be done with thick sheets, and it is in no way desirable, as the strength of the parts are likewise reduced when the thickness of the metal is reduced.

Railway Stockholders.—The *New York Journal of Commerce* annual canvass of the number of stockholders of the principal large corporations in the United States this year covers 234 railway and industrial corporations, of which 91 are railways, with a capitalization of $5,431,852,174. The number of stockholders of the railways is 389,571, the average holdings being 139½ shares. This is an increase over 1910 of 29,275 in the total number of railway stockholders, which is approximately 8 per cent. The increase in railway capital is $97,654,274, or roughly about 2 per cent.

PREVENTION OF ACCIDENTS

In a paper read before the Pittsburgh Foundrymen's Association, April 1, by W. H. Cameron, manager of the casualty department of the American Steel Foundries, Chicago, it was stated that from 30,000 to 35,000 wage earners in the United States die every year from accidents, and that in addition to these fatalities 2,000,000 men are seriously injured. To protect the employees from claims presented because of these accidents, $22,000,000 is spent every year in liability insurance premiums. It has been estimated that not more than 25 per cent. of these premiums reach the sufferers from accidents. Up to seventeen months ago the American Steel Foundries followed the usual custom of protecting itself by carrying accident liability insurance; as it became apparent that the company could control to some extent, at least, the frequency of accidents among its employees, it was decided to conduct an effective safety campaign and that the company should carry its own liability insurance.

At first it was left to the master mechanic at each plant to supervise and recommend the making and installing of safeguards, but as these men were extremely busy and were so accustomed to existing conditions, it did not prove to be entirely satisfactory. Later three men were selected from three different departments of the plant and this committee made four whole day inspections each month. The men selected were not only old employees, but were familiar with all parts of the plant and were known to be conscientious and not afraid to report what they saw. They were paid their full wages while engaged in making the inspection and $5 extra for each monthly report.

During the first month about 1,000 suggestions were received. These were submitted to the three foremen in charge of the departments from which the men were selected, and they acted as a jury in approving or disapproving them. The foremen inspected all of the conditions reported and very few of the suggestions were rejected. The report was then referred to the plant managers and after being passed on by them, the higher officers, feeling that the recommendations had been fully considered from the three different standpoints, accepted them. After a considerable number of safety appliances had been installed it was determined to appoint safety inspectors to devote all of their time and efforts to safety work. They report on everything from loose bricks in the building to slippery floors and stairways. Reports of serious accidents and their causes are discussed at the meetings of the foremen and the heads of the departments, and are treated as seriously as any regular work. The results of the safety committee's investigations are kept in the central office of the company, and this office keeps in constant touch with the safety inspectors. A safety inspector in a plant employing from 500 to 600 workmen will have ample time to investigate accidents as well as to visit injured workmen and to demonstrate to them that the company has an interest in their welfare and speedy recovery.

Cleanliness in and about the shops and yards cannot be too strongly urged, as it is an important factor in causing the men to be more cleanly about their work and in preventing accidents due to untidy conditions. Windows should be kept clean and the walls should be whitewashed regularly; unsuitable clothing should not be worn by men performing hazardous work. It is believed that the money expended for the protection of workmen will be amply returned in the form of better organization and will cause an actual saving in the accident expense accounts.

Driving Wheel Speeds.—The Baldwin Locomotive Works has published the following as a simple method of figuring driving wheel speeds. To obtain revolutions per mile divide 1680 by the diameter of the driving wheel in feet. To obtain revolutions per minute multiply the speed in miles per hour by 28 and divide the product by the diameter of the driver in feet.

LARGEST NON-ARTICULATED LOCOMOTIVE

A Maximum Theoretical Tractive Effort of 71,500 lbs. Obtained With One Group of Drivers and Two Simple Cylinders Makes the New 2-10-2 Type on the Burlington of Particular Interest.

Five pairs of driving wheels have been considered as the largest practical number to be included in one group with a rigid frame, and when there is an average weight of over 60,000 lbs. for each pair, and cylinders are applied of such a size as to bring the factor of adhesion down to 4.22, it would seem as if the limit was practically reached for the non-articulated locomotive. Five engines fulfilling these conditions have recently been delivered to the Chicago, Burlington & Quincy by the Baldwin Locomotive Works. They are fitted with single leading and trailing trucks which together carry 76,900 lbs., making the total weight of the locomotive 378,700 lbs., of which nearly 80 per cent. is on drivers.

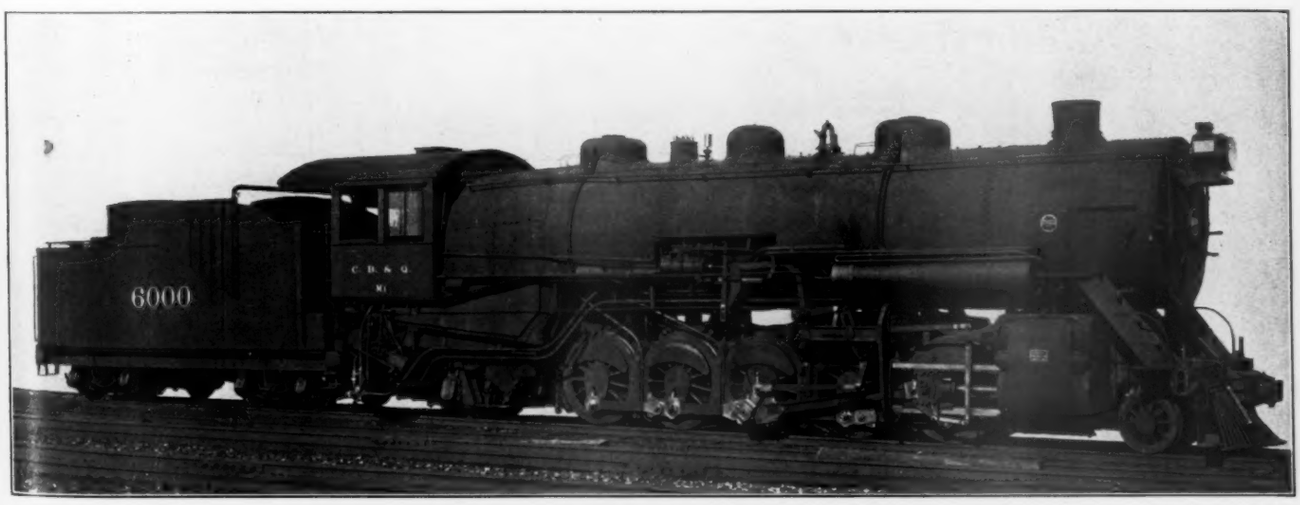
These locomotives were ordered after considerable experience with articulated locomotives of the 2-6-6-2 type* of practically the same power, as well as with Mikado and consolidation locomotives ranking with the largest of their type. It thus appears that for this service a simple locomotive of the non-articulated type fitted with a high degree superheater was considered preferable to the articulated compound designs already in use on that road. These include engines fitted with superheaters, reheaters and feed water heaters, as well as an earlier design, which includs none of these appliances.

Although the 2-10-2 type is not new, there being 160 in use on the Santa Fe and at least one on the Pittsburgh, Shawmut & Northern, there have been none built during the past 5 years, and the previous locomotives of this type were over 90,000 lbs. lighter than the present Burlington engines. Furthermore in the previous designs the trailer truck was applied more for its assistance in curving than to carry weight, and full advantage of the wheel arrangement could hardly be considered to have been taken, as is so completely done in the present case.

There is shown in the accompanying table two locomotives of the lighter 2-6-6-2 type and several of the latest examples of the 2-8-2 type in comparison with this 2-10-2 type. It will be seen that while the Mallets give a somewhat larger percentage of weight on drivers, the new locomotives do not compare very badly in this respect and are of course a considerable improvement over the Mikados. The average weight per driving axle depends on the strength of the track and bridges, and in this respect the Mikado on the Chesapeake & Ohio is the largest of any locomotive shown in the table, although by no means the largest weight per driving axle now in service in this country. Figuring arbitrarily that the maximum indicated horsepower will be delivered with a piston speed of 700 ft. per minute, which in the case of the locomotives shown in the table varies from 22¼ miles per hour for the 57 in. driver to 25 miles per hour for the 64 in. wheel. It will be seen that the new Burlington engine is slightly less than the Mallet on the same road, but that it ex-

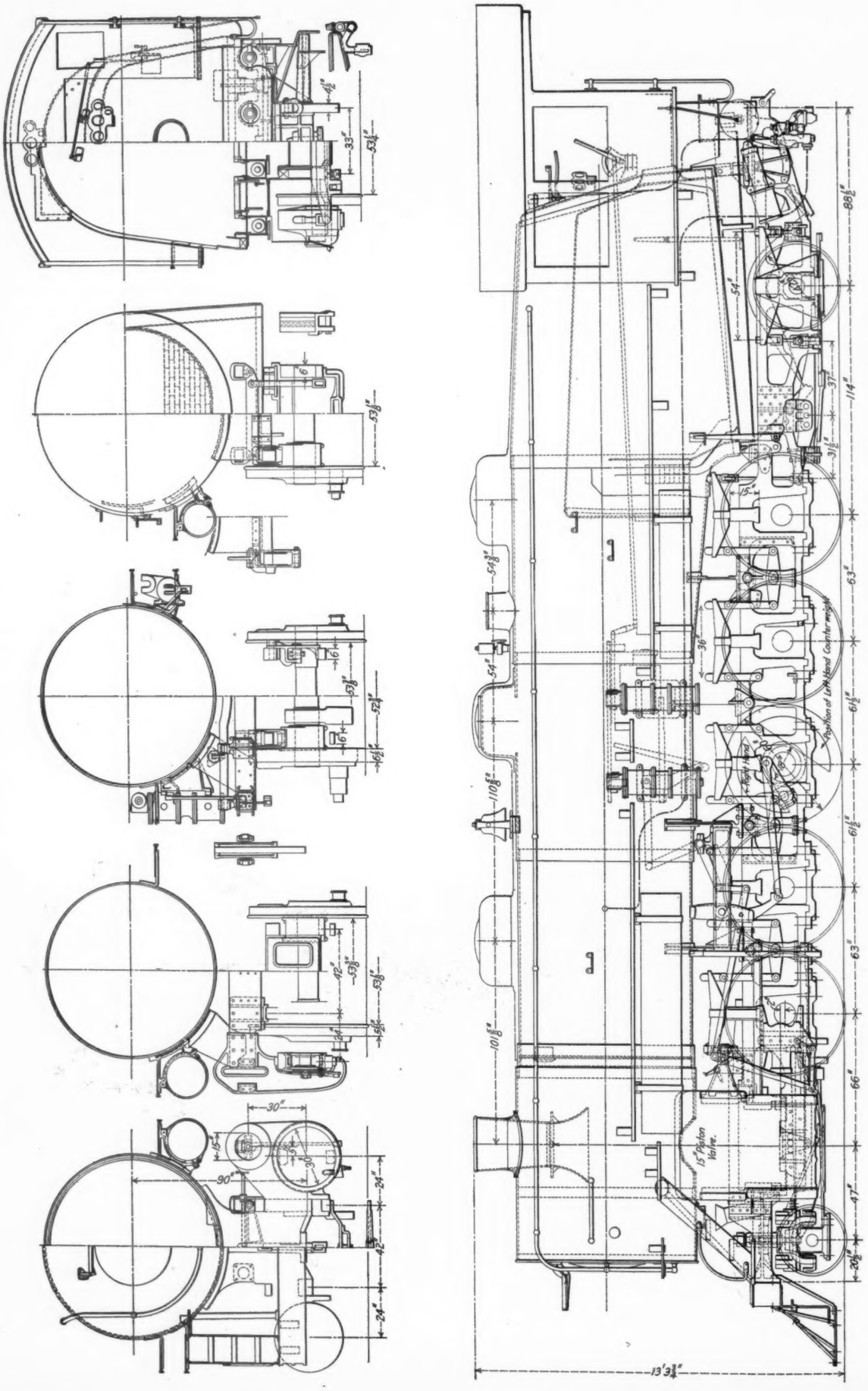
Road	C. B. & Q.	C. B. & Q.	N. Y. C.	Erie.	G. N.	C. & O.
Type	2-10-2	2-6-6-2	2-6-6-2	2-8-2	2-8-2	2-8-2
Total weight, lbs.	378,700	361,650	354,000	320,600	287,000	315,000
Weight on drivers, lbs.	301,800	304,500	301,500	237,150	220,000	243,000
Percentage on drivers	79.7	84	85.2	74	76.5	77.1
Average weight per driving axle, lbs.	60,300	50,750	50,250	59,288	55,000	60,750
Tractive effort, lbs.	71,500	70,500	67,500	57,460	57,460	60,800
Maximum I. H. P.*	2,750	2,900	2,475	2,330	2,330	2,500
Heating surface total, sq. ft.	5,161	5,090‡	4,393	4,155	4,720	4,051
Superheater surface, sq. ft.	970	464	966.3	843	871	845
Equivalent heating surface, sq. ft.	6,616	5,786	5,842.5	5,419.5	6,026.5	5,318.7
Evaporation per sq. ft. of evaporating heating surface, lbs.†	11.2	12	11.85	11.75	10.4	12.95
Cylinders, diameter and stroke, in.	30 x 32	23 & 35 x 32	21½ & 34 x 32	28 x 32	28 x 32	29 x 28
Diameter of drivers, in.	60	64	57	63	63	56

* Taken at 700 ft. per minute piston speed, tractive effort assumed to be .62 of the maximum.
† Steam consumption assumed to be 21 lbs. water per horsepower hour.
‡ Includes the feed water heater.



Most Powerful Non-Articulated Locomotive; Chicago, Burlington & Quincy.

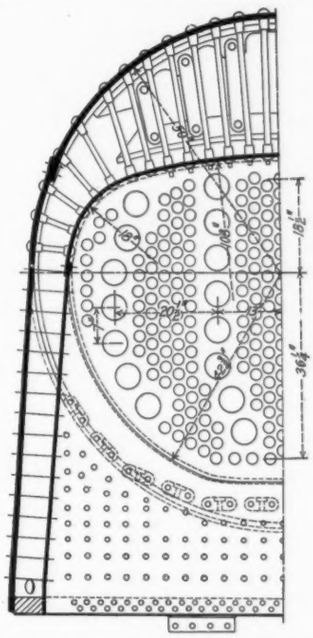
*See *American Engineer and Railroad Journal*, May, 1910, page 171.



A Non-Articulated Locomotive Having a Tractive Effort of 71,500 lbs.; Chicago, Burlington & Quincy.

ceeds all other engines on the list. Even this large power is obtained with a very reasonable average evaporation per square foot of heating surface.

Boiler.—The boiler measures 88½ in. in diameter, and is of the straight top type, although the third sheet increases to a diameter of 96½ in. at its connection to the firebox. The slope is all placed at the bottom of the barrel to give a larger water

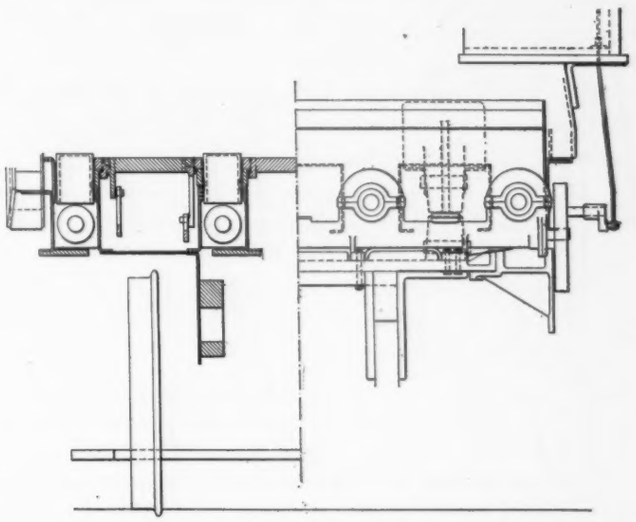


Section of Firebox Showing Arrangement of Flues.

space around the bottom of combustion chamber. As a further improvement to the circulation at this point the front water leg is sloped upward on an easy curve and has a width of 6 in. The clearance around the bottom of the combustion chamber is approximately 7 in. The tubes and flues are 22 ft. 7½ in. in length, there being 285 of the former 2¼ in. in diameter and 30 superheater flues 6 in. in diameter. The combustion chamber is about 27 in. long and it, with the firebox, has a total heating surface of 320 sq. ft., giving the boiler a total evaporative heating surface of 5,161 sq. ft. Assuming a steam consumption of 21 lbs. per indicated horsepower and the maximum horsepower given, it will be seen that the average evaporation per square foot of evaporative heating surface required will be about 11.2 lbs. of water per hour, a figure below any of the others shown in the table with the exception of one. This clearly indicates that the boiler is of ample capacity.

There are no features of particular interest in the construction of the boiler. The crown of the combustion chamber is supported at the top by two T-bars hung on expansion links and the remainder of the boiler is radially stayed. There are 501 flexible staybolts placed in the sides, throat and back head.

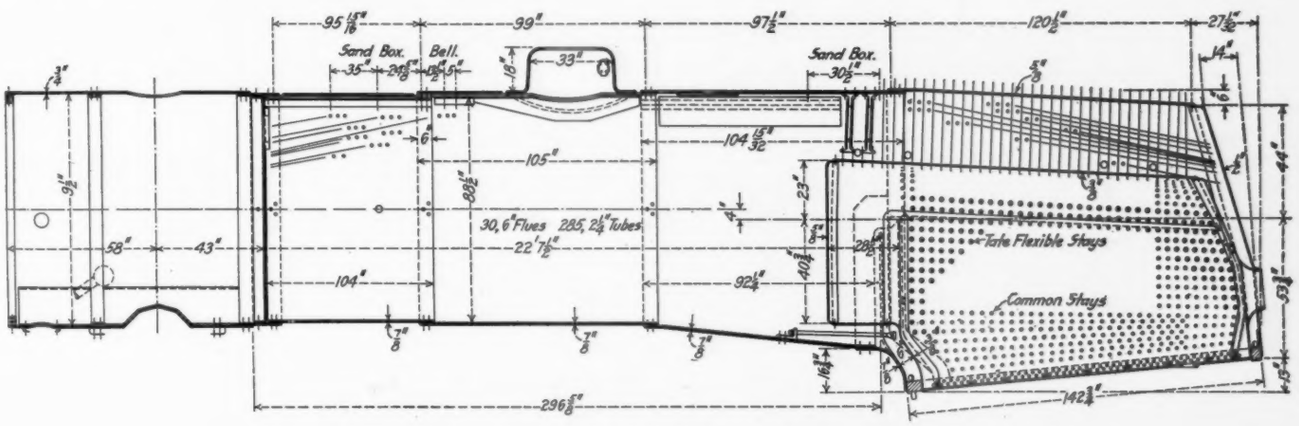
Emerson superheaters, having a surface of 970 sq. ft. on the steam side of the elements and headers, have been applied to these locomotives. They comprise 30 double looped elements, 15 on each header. The superheater tubes are 1¾ in. outside and are placed inside of 6 in. flues. These superheaters are of



Arrangement of Barnum Stoker Troughs in Firebox.

the latest design of this type†, wherein the saturated and superheated steam headers are in separate castings bolted together in such a way as to allow a slight movement, permitting unequal contraction and expansion.

Assume that an efficiency of combustion is obtained on these locomotives which will give an evaporation of 8 lbs. of water per lb. of coal; to develop the maximum horse power of the engine with a steam consumption of 21 lbs. per horse power hour will require over 7,200 lbs. of coal per hour. On the district where these locomotives are to be used, *viz.*, Beardstown



Straight Top Boiler With Combustion Chamber; Burlington 2-10-2 Type Locomotive.

division in Illinois, conditions are such that the maximum capacity will be required practically all of the time, and while there are some firemen capable of handling this amount of fuel, the average fireman cannot do so. It therefore seemed necessary if the capacity of the locomotive is to be utilized, to either provide a stoker or to equip for burning oil. The former method was preferable and the Barnum stoker which has been developed on this road has been fitted to the five locomotives.

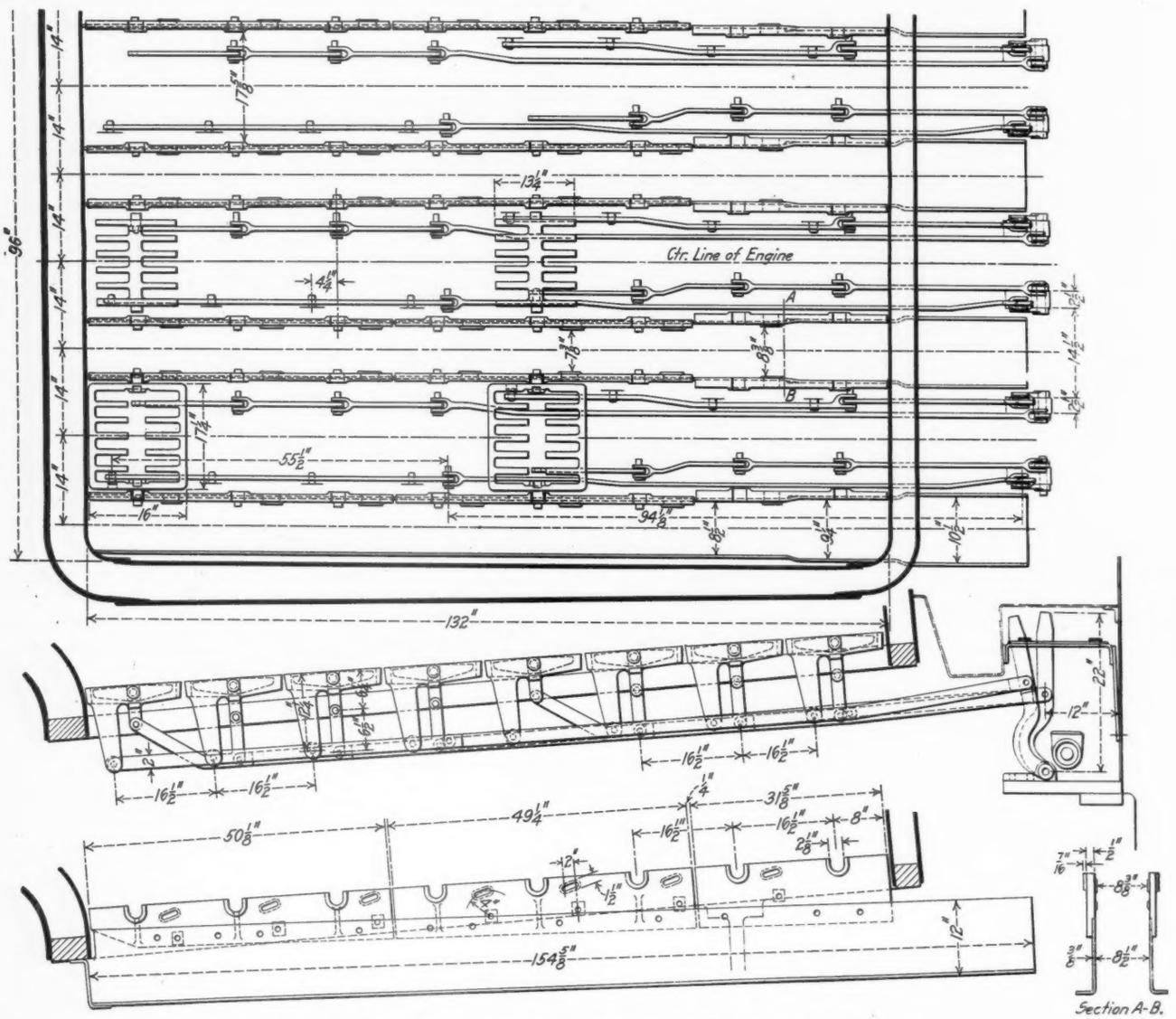
†See *American Engineer and Railroad Journal*, November, 1911, page 425.

Stoker.—This stoker is of the underfeed type employing screw conveyors of a constantly decreasing diameter toward the front end of the firebox, which are set in troughs just below the level of the grates. Above the conveyors in each trough are a series of inclined plates, adjustable for height and inclination. The clearance between the conveyor and the bottom of the trough can also be adjusted to secure the most satisfactory results. The conveyors are operated by a transverse worm shaft under the cab deck which is rotated by two small steam engines secured on the outside of the frames. There are four troughs and conveyors set 28 in. apart, and between them are the grate bars which are shown in detail in one of the illustrations. Each of the three sections of the grate are arranged to shake in two groups, and each grate bar is set in a rectangular frame which can be titled through a wide angle for dumping the fire. Below each of the three sections of the grate is an independent ash pan having two hoppers. All of these hoppers are of the self-clearing type and are fitted with cast iron swinging doors.

A coal crusher driven by a 6 in. x 6 in. steam engine is located on the tender and delivers coal to a belt conveyor which transfers it to a transverse trough from which it is discharged into the longitudinal feed troughs. A Ryan-Johnson coal pusher is fitted in the coal space of the tender.

There is no arch in the firebox, but a brick wall 9 in. thick is built in the combustion chamber and is extended up to a point 38 in. below the crown sheet. The inside of this wall is 16½ in. back of the tube sheet.

Because of the arrangement of the stoker it was not possible to use the usual plate support at the back end of the firebox and two vertical expansion links are employed. These are located 56 in. apart transversely, placing them outside of the frames, and the cast steel deck plate is extended out and fitted with heavy ribs to form a suitable support. At the top the links are pinned to a large casting fitting under the mud ring and on the back head of the boiler. At the front the mud ring is supported on the usual sliding shoes and from this point to the cylinder there are four plate supports.



Grates and Operating Gear on the Burlington 2-10-2 Type Locomotives.

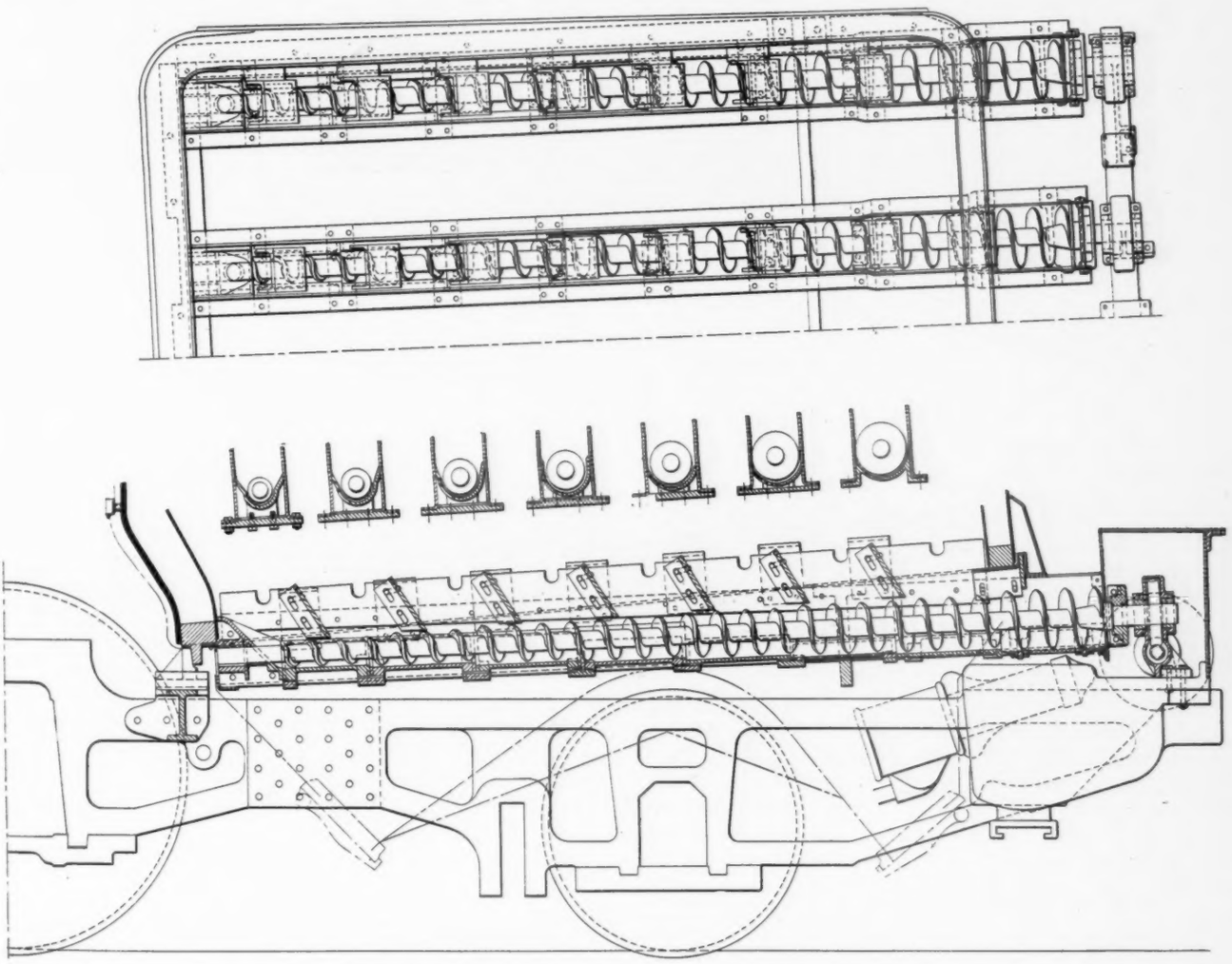
Cylinders.—Cast iron cylinders, each including half the saddle in the customary manner, have been employed. Since the superheater has two separate headers, an equalizer pipe connecting the steam passages in the cylinders has been provided. The cylinder barrel walls are made unusually thick—2 in. because of their large diameter. Cast steel piston heads of the dished type fitted with cast iron bearing rings 6 in. in width, except at the bottom where they are widened to 8 in., are used. The 15 in. piston valves‡ are of the double ported design similar to those employed by the same builders on the Nashville, Chattanooga

‡See *American Engineer*, March, 1912, page 141.

& St. Louis Pacific type locomotives. Circulating or drifting valves of the Sheedy type are provided and relief valves are tapped into the live steam passages. The guides for the valve stem crosshead are cast in one piece with the back steam-chest head. A Ragonet power reverse gear is employed.

Frames.—The frames are steel castings 6 in. wide with separate rear sections 4½ in. wide. Included in the castings at the proper points are thin webs for suitably attaching the frame braces. By this method the frame itself is not weakened by the numerous transverse bolt holes, and at the same time the braces have a better bearing and are more securely fastened. The construction and arrangement at the front pedestal and around the cylinders is particularly interesting. Separate front rails at the top and bottom are employed, but the bottom rail of castings. At the top the rail is carried back well over the pedestal. This is one of the strongest and stiffest arrangements where separate double front rails are employed that has ever been illustrated in these columns.

Tranverse frame braces are liberally employed and include a horizontal steel casting just back of the cylinders, which is bolted to the cylinder castings as well as the frames. Between the first and second pair of driving wheels the guide yoke acts as a frame brace and the valve gear bearer answers this purpose between the second and third pair. Just at the rear of the second pedestal is also a heavy cast steel ribbed brace in a vertical position secured to the 1½ in. webs forming part of the main frame castings. A similar brace is found in front of the fifth pedestal. Between the third and fourth and the fourth and



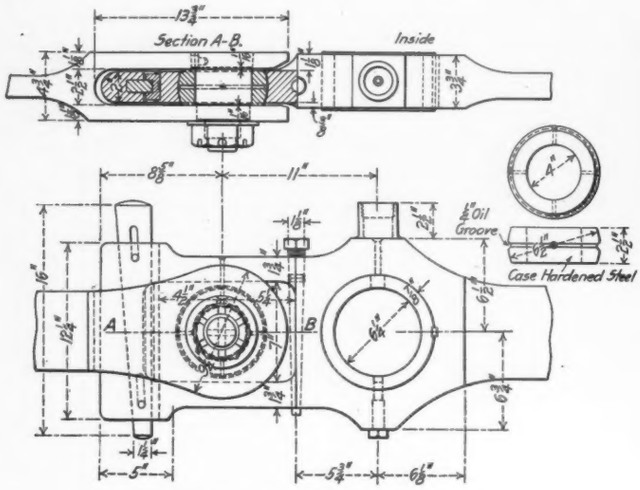
Barnum Underfeed Stoker Applied to Burlington 2-10-2 Type Locomotive.

the main frame is also carried forward underneath the cylinders for a distance of about 39 in. This extends below the lower front rail, which is of cast steel and arranged to accurately fit into the main frame back as far as the pedestal leg. The front rail includes a lip 2¼ in. thick extending down on the inside of the main frame for its full length, and also up the inside of the front pedestal leg nearly to the top. This inner lip has a stiffening web in the corner and also extends downward on the inside below the main frame, ending in a jaw which carries the bearing for the main brake shaft. Both of the front rails end just in front of the cylinders where they are bolted and keyed to a cast steel deck plate. There are 9 horizontal and 9 vertical bolts, as well as a large key securing the lower front rail and the main frame. Part of these bolts also connect to the cylinder fifth drivers are heavy horizontal frame braces which also act as supports for the boiler braces. Shoes and wedges are of bronze and the pedestal binders are of cast steel lugged and bolted to the frames in the usual manner. Castle nuts are employed on these bolts.

Rods and Driving Wheels.—The main rods are of I section, but the side rods are rectangular in section. They offer no particular features of interest except the side rod stub ends at the second and fourth drivers. A detail of the construction at this point is shown in one of the illustrations, and it will be seen that the knuckle pins on the stub ends are surrounded by spherical bushings of case hardened steel, fitting in braces having a wedge adjustment. This arrangement was employed since the locomotives are designed to traverse 21 deg. curves and

the front and rear pairs of driving wheels are permitted considerable side motion. Blind tires are employed on the main drivers; the second and fourth drivers have their tires set in to give a clearance of 5/8 in., and the front and back tires have a clearance of 7/8 in. This in connection with the side play allowed in the boxes necessitated the employment of some method to permit the side rods to adjust themselves without binding.

Vanadium steel is used in the main driving axle and the main crank pins. It was found impossible to provide the necessary amount of counter-balance in connection with the main wheel

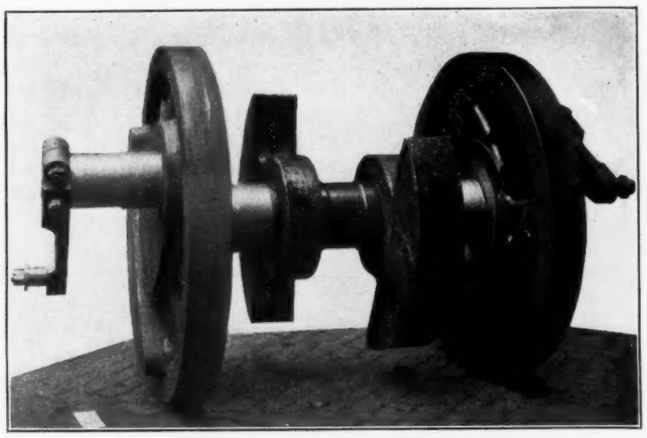


Spherical Bearing on Side Rods.

centers, and therefore large cast steel counter-weights have been placed on the main axle inside the frames. These are pressed on and keyed in place.

Four 12 in. x 10 in. brake cylinders are employed, two being bolted to the guide yoke and operating the brakes on the first three pairs of drivers. The other two are secured to the frame brace between the fourth and fifth pairs of drivers and operate the brakes on these wheels. Two 11 in. air pumps are provided.

The equalization system is divided between the third and fourth pairs of drivers. All driving springs are mounted over the driving boxes and cast steel equalizers are used throughout



Main Driving Axle With Counterbalance Weights.

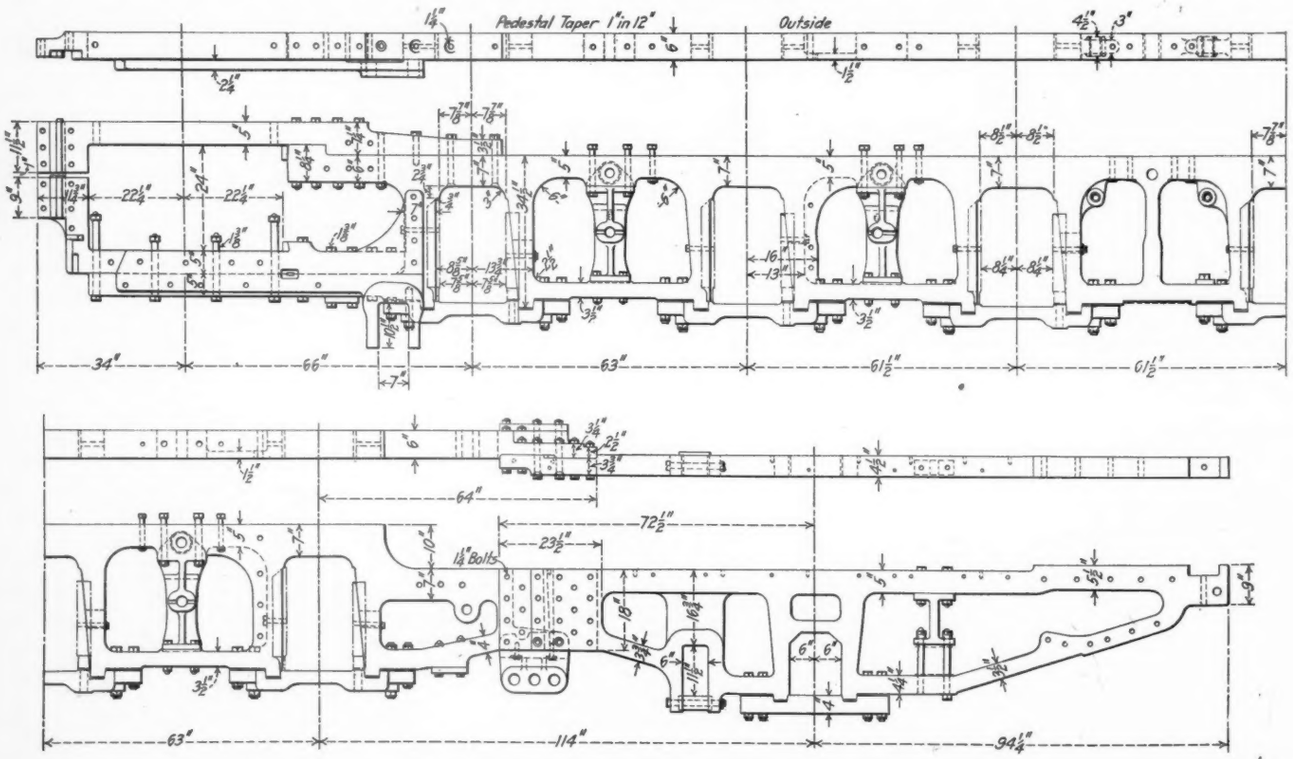
with the exception of those extending under the rear trucks, which are of forged iron.

Twelve inch steel channels are used in the framing of the 10,000-gal tender, which has a front bumper beam of oak, and a back bumper beam built up of steel plates.

General dimensions, weights and ratios are shown in the following table:

General Data.

Gage	4 ft. 8½ in.
Service	Freight
Fuel	Bit. coal
Tractive effort	71,500 lbs.
Weight in working order	378,700 lbs.
Weight on drivers	301,800 lbs.
Weight on leading truck	26,600 lbs.
Weight on trailing truck	50,300 lbs.
Weight of engine and tender in working order	562,000 lbs.
Wheel base, driving	20 ft. 9 in.
Wheel base, total	39 ft. 8 in.
Wheel base, engine and tender	74 ft. 4¼ in.



Cast Steel Frames; the Construction at the Cylinder Connection is Unusually Heavy and Strong.

Ratios.

Weight on drivers ÷ tractive effort	4.22
Total weight ÷ tractive effort	5.30
Tractive effort × diam. drivers ÷ equivalent heating surface*	647.00
Tractive effort × diam. drivers ÷ total heating surface	830.00
Total heating surface* ÷ grate area	58.70
Firebox heating surface ÷ equiv. heating surface*, per cent	6.22
Weight on drivers ÷ equiv. heating surface*	58.60
Total weight ÷ equiv. heating surface*	73.40
Volume both cylinders, cu. ft	26.18
Equivalent heating surface ÷ vol. cylinders	253.00
Grate area ÷ vol. cylinders	3.36

Cylinders.

Kind	Simple
Diameter and stroke	30 x 32 in.

Valves.

Kind	Piston
Diameter	15 in.
Lead	¼ in.

Wheels.

Driving, diameter over tires	60 in.
Driving, thickness of tires	4 in.
Driving journals, main, diameter and length	12 x 12 in.
Driving journals, others, diameter and length	11 x 12 in.
Engine truck wheels, diameter	33 in.
Engine truck, journals	6 x 10 in.
Trailing truck wheels, diameter	42½ in.
Trailing truck, journals	8 x 14 in.

Boiler.

Style	Straight
Working pressure	175 lbs.
Outside diameter of first ring	88½ in.
Firebox, length and width	132 x 96 in.
Firebox plates, thickness	⅜ & ⅝ in.
Firebox, water space	F—6 in.; S—4 to 6 in.; B—4 in.
Tubes, number and outside diameter	285, 2¼ in.
Tubes, thickness	No. 11 B. W. G.
Flues, number and outside diameter	30, 6 in.
Flues, thickness	No. 8 B. W. G.
Tubes, length	22 ft. 7½ in.
Heating surface, tubes and flues	4,841 sq. ft.
Heating surface, firebox	320 sq. ft.
Heating surface, total	5,161 sq. ft.
Superheater heating surface (steam side)	970 sq. ft.
Heating surface, equivalent	6,616 sq. ft.
Grate area	88 sq. ft.

Tender.

Tank	Water bottom
Frame	Steel
Wheels, diameter	33 in.
Journals, diameter and length	6 x 11 in.
Water capacity	10,000 gals.
Coal capacity	15 tons

* Total heating surface plus 1.5 times the superheating surface.

RECLAIMING LOST EFFICIENCY

BY H. M. FITZ.

The question is asked daily: "Why does it cost more today for labor to produce a certain commodity than it did a year or two ago? At that time we could show a gain, now we show a loss." Have not the wages of many been increased on account of demands, without any regard for efficiency or reference to standards? Why not increase wages according to efficiency and standards, thereby decreasing the cost? There would be a mutual benefit to employees and employer; efficient production ceases when the employee loses confidence in the employer. To reclaim lost efficiency is different from anything else; we find it necessary first to regain the confidence of the employee.

Many of us wonder why so many premium, bonus or piece work systems fail. The real wonder is that more do not fail. Many well-founded projects—thoroughly studied plans or systems of merit—have suffered relapse, have sometimes been discontinued and thought to be a losing proposition on account of misapplication or lack of attention, especially to details. Man, himself, must have a little system of his own personal needs; the better his health, the greater his capacity should be for doing things.

I have in mind a large railway, employing thousands of men, which at one time maintained a betterment department for the express purpose of making and maintaining standards, effecting economies, supervising all efficiency work and helping, aiding and assisting in prescribing the best methods of procedure in the mechanical department; at the end of each year it showed a substantial financial saving which was effected through the efforts of the betterment organization. Its system was to the company what a man's health is to himself; when your organization is tampered with, used for mere experimental purposes, or a little authority is unjustly exercised, or there is a lack of attention, it is bound to suffer the penalty of these faults, the same as a man does when his health is neglected.

In this particular instance, after standards were formulated and were being maintained in certain departments, and the efficiency had increased from 15 to 120 per cent. over that formerly attained, there arose all sorts of criticisms, complaints and fault-finding by other departments, who lived in constant fear of having their hair trimmed, and of being shown how to economize and to work more efficiently to earn their already high salaries. Little things of a detrimental nature were allowed to creep in, and these eventually had their effect.

There were criticisms from the store department that the mechanical department would no longer accept material that did not fill the requirements, with an added expense to make new and supposedly standard material serviceable. Substitution was its long suit. The store department received credit for carrying a small stock and few sizes. Presumably it was a very efficient department; 10 in. bolts were furnished where 5 in. ones were wanted; it was easy to cut them off and rethread them. A thousand and one similar cases had to be discontinued in order to reduce repair costs.

The transportation department complained that engines were not receiving proper care at terminals, which caused leaky flues or insufficient steam while on the road. This was attributed to the economical handling of these engines. On investigation it was found in nine out of ten cases that the engine was hauling far in excess of its tonnage, and that the crew was straining every joint to get it over the division, or the engine was mistreated by the crew by leaving the fire door open, or injecting too much cold water into the boiler at one time, or by the fireman not working in harmony with the engineer. The engineers' union decided to buck it, and started to complain about the repairs on the locomotives they ran, not from an economical standpoint, but from their own selfish point of view. Records are the silent witnesses, and show that more and better repair work was done under the betterment system than formerly.

The accounting department also came in, not being satisfied with what really and truly belonged to it, and became a destructive critic. Not even knowing the first principles of efficiency it undertook to dictate and did inject foreign and injurious rules, made rank decisions, and issued the most impractical instructions possible. These, and many more instances caused employees to lose faith in the company's intentions—not in the principles of efficiency, but in the way that true benefits were from time to time suppressed.

None of these departments gained anything, but have sustained a loss of thousands of dollars, as did also the company. We are asked, "Why not reclaim lost efficiency?" Part of it can be reclaimed, and the part that cannot is wasted time. This is lost and no one feels it more keenly than those connected with the efficiency work. I share the belief of the winner of first prize on the subject "Reclaiming Scrap" in the March *American Engineer*, that with the proper supervision, serviceable material should never reach the scrap pile. Neither is there any excuse for a good efficiency system to reach the reclaiming stage.

REMARKABLE STEAM TURBINE.—A steam turbine that will carry a maximum load of 35,000 h. p. has recently been installed for the Brooklyn Rapid Transit Company.

WIRELESS TELEGRAPHY.—The Marconi Wireless Telegraphy Company, of England, has made a contract with British post office department for the construction of wireless stations at London, Alden, Bangalore, Pretoria and Singapore, which will be part of the system the British government contemplates extending around the world.

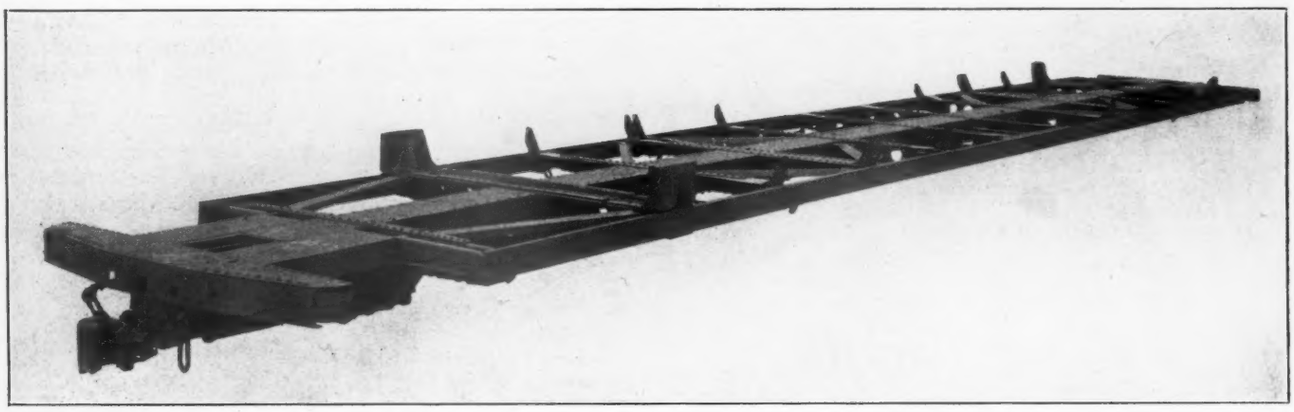
ALL-STEEL ELECTRIC SUBURBAN CARS

Used in Multiple Unit Service and Employing Pressed Shapes to a Greater Extent Than Has Ever Before Been Attempted in Passenger Equipment.

The New York, Westchester & Boston will soon put into operation its four track line running through the borough of the Bronx, New York City and Westchester county. This road has been built on a private right of way of the heaviest character of construction, is without grade crossings, and will be devoted almost exclusively to high speed heavy suburban traffic. The trains will all be of the multiple unit type and the cars are provided with full vestibuled platforms and diaphragms, and are arranged to give the same comfort, capacity and safety as the latest type of steel cars for steam operation. The construction of the car, however, is specially suited for multiple unit service and would not fulfill the requirements of ordinary steam operated trains.

tion these cars are of the type in which the side frame is designed to carry the whole load. Light center sills are included for directly transmitting the pulling and buffing shocks only, and even the weight of these is carried by the side framing.

Pressed steel shapes are liberally used throughout the car, and in the side framing particularly, full advantage has been taken of this form of construction to give the maximum strength with a minimum weight. The entire side framing of the car, from the side sill to the plate, forms the load-carrying girder. This is built up of 12 pressed steel units, each of which includes the facing of the main posts, diagonal braces on each side of the bottom and one-half of a Gothic arch on each side at the

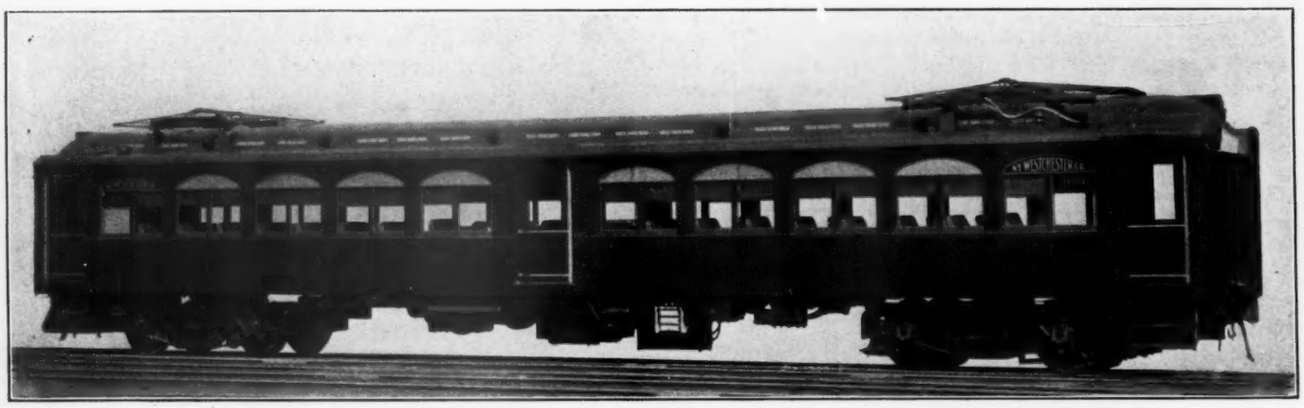


General View of Underframe of Steel Suburban Car; New York, Westchester & Boston.

Center side doors have been included since practically all of the station platforms are at the car floor level and all doors in the car are to be operated by a guard on the platform in a manner similar to that used in subway service.

There were 28 passenger cars and 2 combination coach and baggage cars in the initial order. They are 70 ft. long over the vestibule end sills and 9 ft. 7¾ in. wide over the main posts.

top of the post. These units are pressed and flanged in one piece from ¼ in. steel plate and are secured at the bottom to a 7 in., 12¼ lb. channel forming the side sill and the tension member of the side girder. At the top the units form a butt joint, reinforced at the back by a plate and welded on the face. These pressed units are reinforced by the main posts, which consist of a pair of pressed steel shapes of channel section and



All-Steel Suburban Electric Car in Which Pressed Steel Shapes are Liberally Used.

The height from the rail to the top of the roof is about 13 ft. 3½ in. The passenger cars have a seating capacity of 78, while the combination car seats 54 passengers and include a baggage compartment 16 ft. 5 in. long. They were designed in the office of L. B. Stillwell, consulting electrical engineer of the road, and were built by the Pressed Steel Car Company.

As is generally believed to be advisable for multiple unit opera-

include the lower deck carlines. The posts are riveted to the facing throughout their length and are secured to the underframe by gussets connecting them to the cross bearers. The construction and arrangement at this point is clearly shown in one of the photographs. The joint between the pressed steel units at the top is stiffened and reinforced by intermediate lower deck carlines of pressed steel. It is readily apparent that a

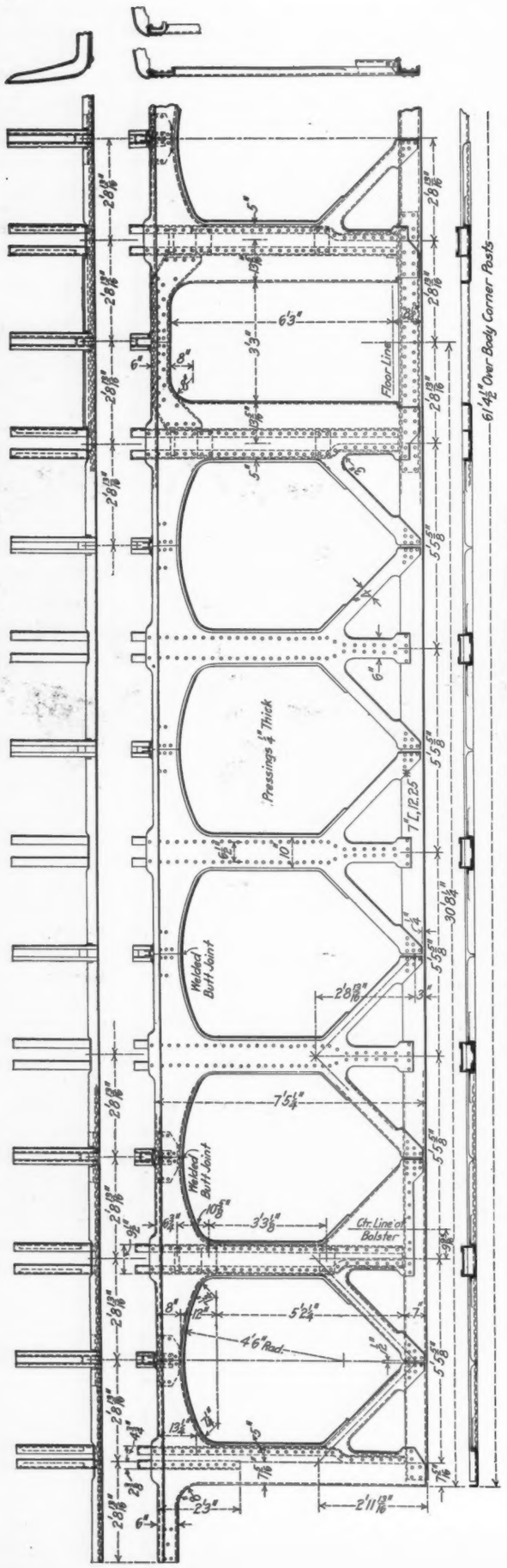
structure of this type is exceptionally stiff and strong with a moderate weight.

At the center door the diagonal braces at the bottom are of course omitted and here there is an extra reinforcement on the inside of the side sill. At the point of connection with the bolsters it will be seen that the structure is somewhat heavier than at other points, although the members there are of the same general form. The lower deck plate is also of pressed steel suitably shaped for the best connection with the pressed steel carlines. It is continuous for the full length of the car.

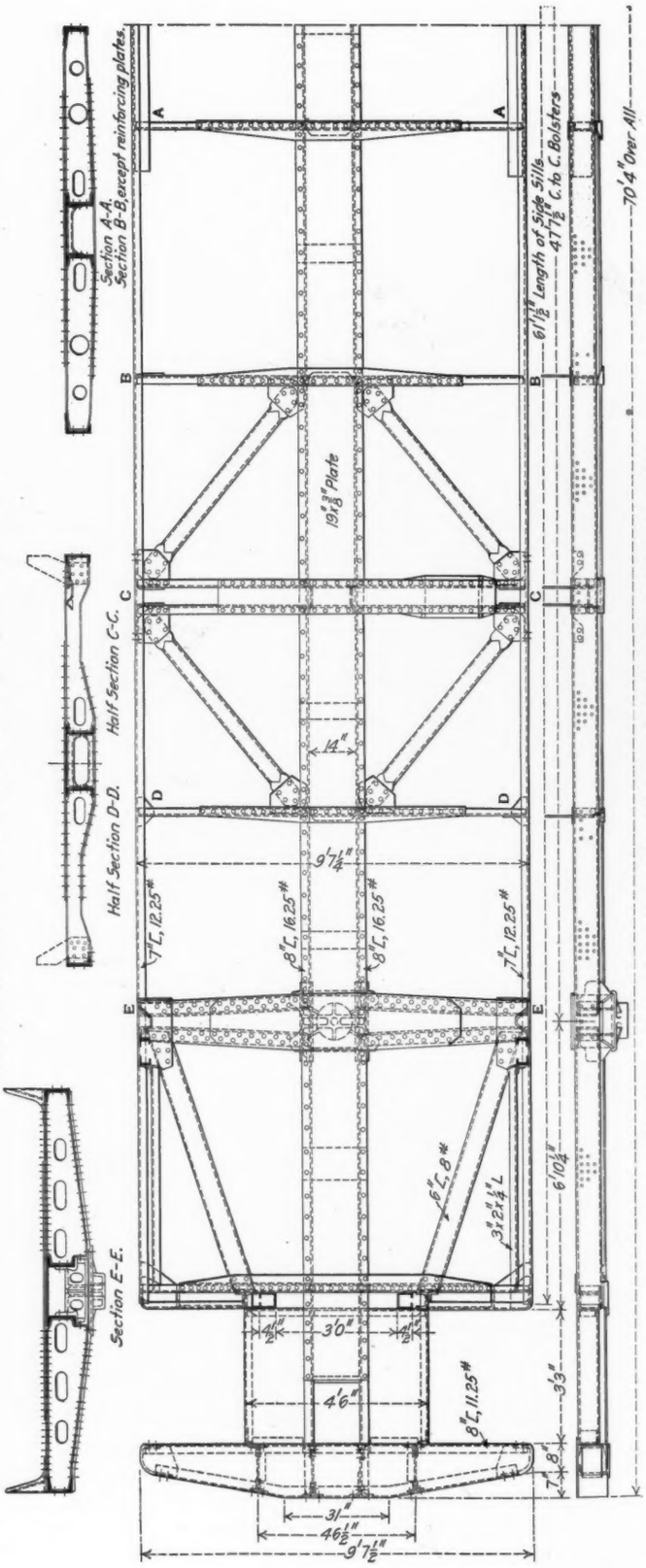
The center sill in the underframe is formed of a pair of 8 in., 16 ¼ lb. channels, set 14 in. apart with flanges projecting outward, continuous for the full length of the car and have a cover plate for the full length on the top only. The cross bearers are of 3/16 in. pressed steel in the form of dished sections fitting between the longitudinal sills and one is placed at each of the posts, or there are eight between the bolsters. Tie plates pass above and below the center sill and for about two-thirds of the distance to the side sills on either side, to which the flanges of the dished section are riveted. The second cross bearer inside the bolsters is double and from its connection to the side sill there are pressed steel braces extending diagonally on both sides to the connection of the adjacent cross bearers with the center sill, where they are secured by gusset plates in the corners. The webs of all the cross bearers are largely cut away to permit the passage of conduits and piping. The sections between the center sill channels are also largely cut away in the web for lightness and to permit the passage of air, as will be explained later. The bolsters are of similar construction, but somewhat deeper and include a casting between the center sills instead of the pressed steel stiffeners used in other cases. The arrangement of the pressed steel knee, stiffening the connection to the side framing at the bolster, is clearly shown in the illustration.

The outside of the car below the windows is sheathed with 1/16 in. American ingot iron plate secured and stiffened by a pressed steel belt rail and other pressed steel members arranged as shown in the illustrations. Above the window sills the steel framing forms the sheathing as well. The roof is also formed of 1/16 in. ingot iron sheets about 2 ft. 8 in. wide and continuous from one side of the car to the other. They are lapped over the carlines and riveted and the joint is then welded by the oxy-acetylene process. Fixed deck sash and exhaust ventilators are provided. The floor is 1¼ in. monolith laid on keystone corrugated sheets. On the under side, the floor is faced with ¼ in. Agasote heat insulation, and is covered with No. 24 galvanized sheet steel. On the inside, the roof and space below the windows between the side posts is lined with a ¾ in. layer of special insulating material made by Samuel Cabot, Inc., Boston, Mass. This is covered with fire proof burlap and the entire interior of the car is finished with a facing of Agasote. White enamel paint giving a maximum reflection of light is used on

Showing the Extent to Which Pressed Steel Shapes are Used in the Framing of the All-Steel Suburban Cars.



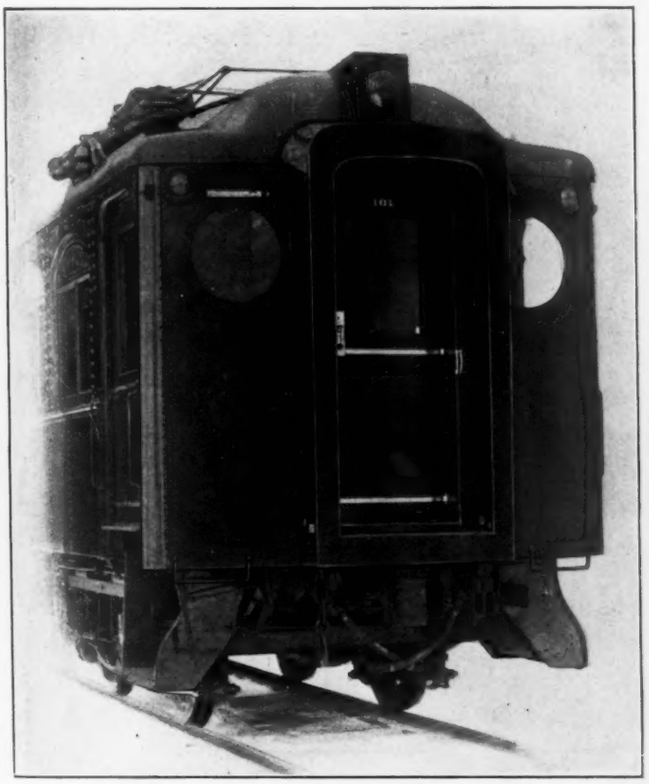
Elevation of Side Frame Showing Form of Pressed Steel Units.



Underframe of the New York, Westchester & Boston Steel Suburban Car.

the head lining and dark green on the sides. On the exterior the cars are painted the standard New York, New Haven & Hartford coach color.

On account of the probability of occasionally operating these cars over sections of the New Haven which are not provided with elevated platforms, steps have been provided. They are covered with Edwards trap doors. The side and end doors are of the sliding type operated electro-pneumatically, the control being by means of switches in the vestibules. The door operating mechanism was furnished by the Consolidated Car Heating Company, who also provided the electric heaters mounted under the seats. The end framing of the car body and of the



Vestibule of All-Steel Suburban Car.

vestibule is of pressed steel members, and is faced with steel plates. In the end of the vestibule are two fixed circular windows 20 in. in diameter, and below the window on the right hand side in each vestibule are mounted the master controller and the engineer's brake valve, these being inclosed by a folding cab door when not in use. On the other side is an H. R. ratchet brake handle.

In the coupler and draft equipment these cars conform to the standard arrangement of the heavy steam railway passenger cars. The coupler of the Buhoup three-stem type, has the M. C. B. standard contour with 10 in. knuckle. It is attached through a pivot pin to a Forsyth friction draft gear consisting of 28 plates and having a capacity of 175,000 lbs. This is carried in a steel housing secured to the center sills just back of the body end sill. The buffer plate is backed up by a Forsyth buffing device consisting of two large helical springs and friction leaf springs with a capacity of 250,000 lbs., giving a total buffing capacity of 425,000 lbs. to the car.

Fifteen of the cars are equipped with nine Garland ventilators mounted on the sloping sides of the upper deck between the stationary deck windows. The remainder each have twelve ventilators furnished by the Gold Car Heating Company. Globe ventilators are used for the saloons in all cars.

Artificial lighting is furnished by forty-five 40-watt tungsten lamps mounted on the lower deck and distributed so that a lamp is directly above each seat. These lamps are wired in multiple on a 110-volt circuit fed from a tap on the main transformer. There are also ten 10-watt tungsten lamps on a separate circuit connected to a 32-volt storage battery.

All of the present order of cars are equipped as motor cars and the weight complete is estimated at 120,000 lbs. A car of similar design equipped as a trailer and without center doors, but seating 88 passengers, would weigh approximately 80,000 lbs. Only one of the trucks is used for traction, and it carries two Westinghouse six-pole, single phase motors operated under forced draft ventilation and having an hourly rating of 175 h. p. These motors are sufficiently powerful to develop an acceleration of one mile per hour per second on a straight and level track. The other truck is very similar in design to the motor truck, but has smaller wheels and a different arrangement of brake rigging. The truck side frames in both cases are of the arch bar type with cast steel pedestals enclosing triple coil springs over the journal boxes. A heavy Z-bar is used for the top arch bar, while the inverted arch bar is a heavy angle securely riveted on the back of the top flange of the Z-bar over the journal boxes. The transoms are pressed steel channels and are attached to the side frames by large cast steel corner brackets. The bolster is of the pressed steel box type. 14 in. in width, and rests on quadruple elliptic springs, which in turn are carried by saddles suspended by swinging links hang-

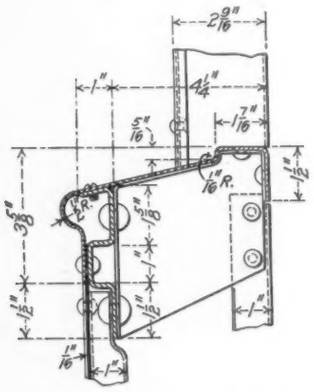
Interior of All-Steel Suburban Car.

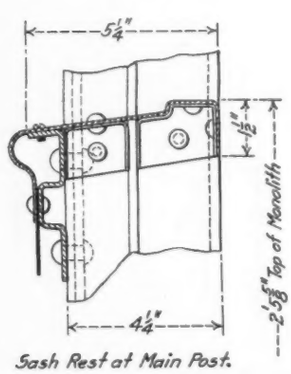
ing from pins in the cast steel corner brace between the transom and the side frame. The spring seats on each side are connected by the spring plank.

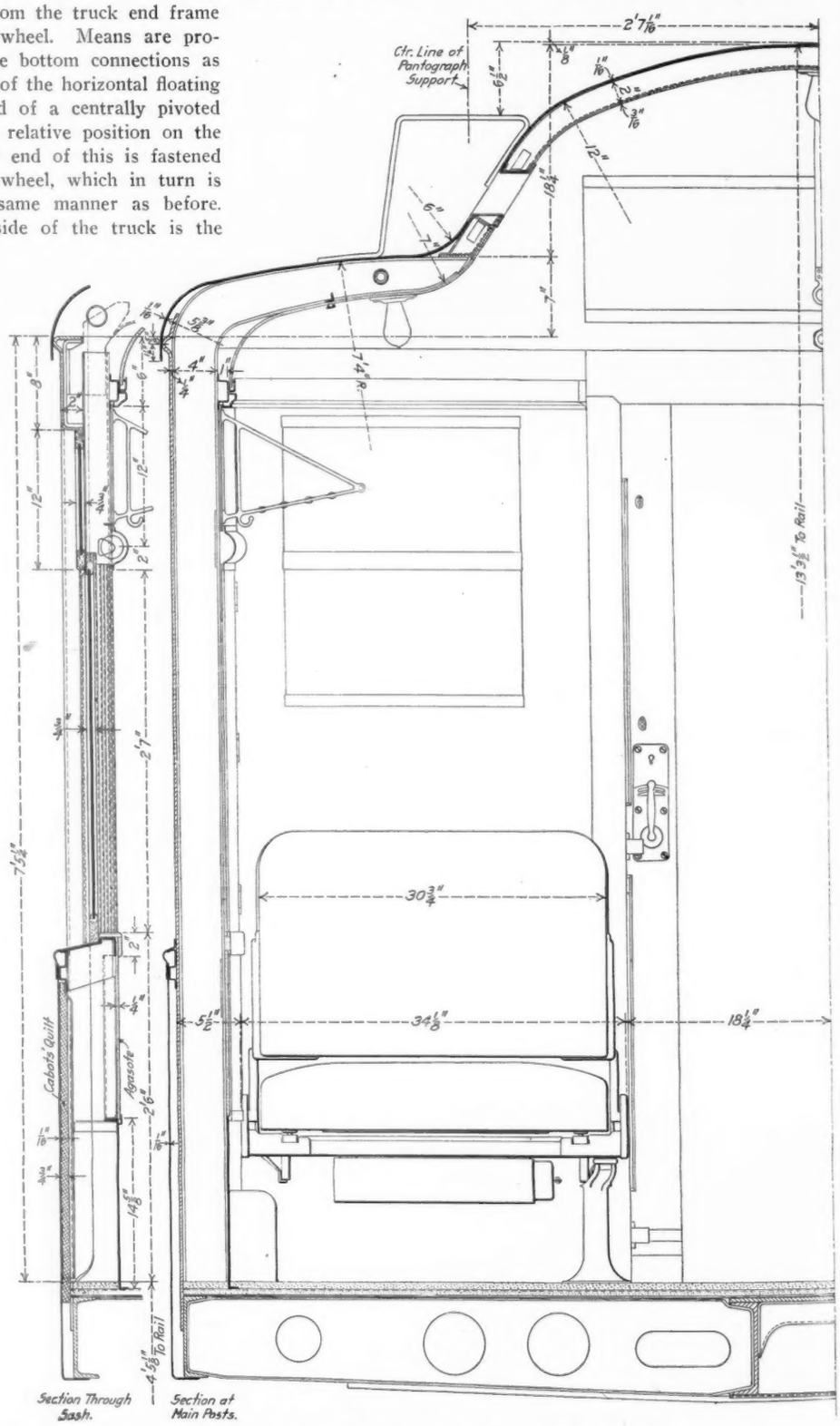
Each motor truck is fitted with eight brake shoes, two to each wheel. The purpose of this is to reduce the pressure per unit of shoe area and minimize the heating effect, as the regular schedule in which these cars will be used involve frequent station stops from high speeds. The brake rigging on the motor truck comprises a radius bar at the inner end of the truck frame to the center of which the rod from the cylinder is connected. From each end of this radius bar a rod extends toward the transom and is attached to the center of a short horizontal

floating lever located above the side frame. The inner end of this lever is fastened to the top of the live brake lever which carries the shoe bearing on the inside of one wheel. Below the shoe is a pair of rods straddling the wheel and connecting to the bottom of a dead lever hung from the truck end frame which carries the other shoe on this wheel. Means are provided for adjusting the length of these bottom connections as these shoes wear. From the outer end of the horizontal floating lever a rod connects to the outer end of a centrally pivoted lever of the same length in the same relative position on the other side of the transom. The inner end of this is fastened to the live brake lever of the other wheel, which in turn is connected to the dead lever in the same manner as before. The arrangement of levers on each side of the truck is the same, the two operating independently except for the single connection through the radius bar. A spring releasing gear is included on either side. The trailer truck brakes are of the inside type with a top beam connecting the two levers. The braking power on these trucks is considerably less than on the motor trucks, and four brake shoes are sufficient. No brake beams are used on either truck.

Present day operation of electric trains as exemplified on the New York, Westchester & Boston has made necessary the development of a brake apparatus of greater power and efficiency than that formerly used in steam or electric service, and the brake equipment on these cars represents a radical departure from the customary practice. After carefully studying the conditions, it was evident to the Westinghouse Air Brake Company that the fundamental functions of the ordinary quick-action automatic air brake would have to be supplemented by a number of additional functions, some of which could be supplied only by the addition of electric control to the pneumatic portion of the brake apparatus. Therefore the equipment as applied consists of a combination of the latest form of pneumatic service and emergency apparatus with electric control for either operation. While the electric control is used normally, the pneumatic is held in reserve without its efficiency being impaired.







Cross Sections Showing Construction of Exterior and Interior Finish, All-Steel Suburban Car.

Two brake cylinders, a supplementary reservoir, a control valve and the engineers' brake valve, in addition to the usual cut out cocks, complete the brake equipment which is designated as schedule A. M. C. E. One brake cylinder 14 x 12 in. is connected through suitable foundation brake gear to the motor truck, and the other cylinder 12 in. x 12 in. is connected to the trailer truck brakes. The operation of the brakes on the two trucks is entirely independent. With a brake pipe pressure of 70 lbs. the full service application will give a pressure of 50 lbs. in the cylinders. The emergency application, however, gives a pressure of from 90 to 100 lbs. in the cylinders, the connection being made directly to the main reservoir. A single control valve performs automatically all the functions of the triple valve. and in addition provides for maintaining the pressure in both brake cylinders constant against leakage. It is arranged to produce full emergency pressure at any time irrespective of the pressure which may be in the brake cylinders. This control valve operates for either electric or pneumatic applications.

Trailing Truck; New York, Westchester & Boston Suburban Car.

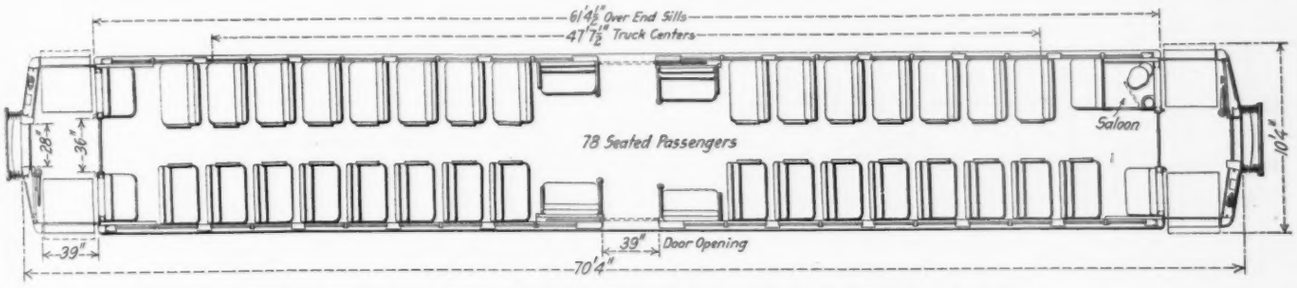
In the brake valve the portion controlling the pneumatic operation of the brakes is supplemented by the connections for the electric control of the system. A distinction between the two methods of application lies in the manner in which the brake pipe reduction is made. In the electric control the brake pipe reduction is made close to the cylinders by the service appli cation magnet valve. In pneumatic operation, however, the brake reduction is made through the brake or engineer's valve only. The handle on this valve occupies the same position for either electric or pneumatic operation at any point, and in case the electric features should be rendered inoperative the pneumatic control will automatically come into use.

Air for forced ventilation of the motors and transformers is supplied by a motor driven blower attached under the car body. This draws its supply from openings in the side of the car to insure its being as free from dust as possible, and discharges into the center sill which for the distance from the blower to the motor truck is covered by a plate on the bottom and utilized as a duct to take the air to the motors. There is a bellows connection of heavy canvas connecting this duct with the opening in the motor casing. Passages are provided in the armature and around the field coils by which the air cools every part of the motor.

The motors, transformer, pantograph trolleys, blower outfit, switch group and all electric equipment on each car has a total weight of 24,450 lbs. There are three running positions in either direction on the controller and three intermediate positions. At the former the motors are connected without resistance to three different taps on the transformer, making it possible to run the equipment continuously at any one of three speeds. With the intermediate positions, however, resistance is included in the circuit. The acceleration is controlled by an automatic relay and the unit switches will not close for the second or third running positions until the proper reduction in pressure is attained, even though the control handle be thrown immediately to the third position. Master controllers are provided with automatic release or "dead man's handle" for cutting off the current to the motors and automatically applying the brake in case the motorman's hand is removed from the control lever. An over-speed relay is provided to prevent the cars exceeding a speed of 57 miles per hour, which was determined as a suitable maximum speed for the service.

A motor generator set furnishes the current for operating the magnet valves of the switches and also for charging a 32-volt storage battery. In case the power goes off the line this storage battery takes up the work of the motor generator and supplies the current for the control apparatus, for the operation of the brakes, for the valve magnets and for the door operating devices as well as for the ten emergency lamps provided in the car.

Two pantograph trolleys are located on the roof above the center of each truck. These are raised and lowered by means of air cylinders controlled by automatic valves operated by push buttons at the master controller. Either of the pantographs can be used to supply current to the car, and two are provided so that there will always be a spare trolley connection available.



Plan of Center Side Door Steel Passenger Car; New York, Westchester & Boston.

Good Roads.—The Department of Agriculture calculates that 300,000 miles of road must be improved before the public road system of the country will be of enough consequence to be appreciable. There are now but 190,476 miles of improved roads in this country, or 8.66 per cent. of the total mileage of all public roads, improved the unimproved. The French system of roads. long considered the best in the world, was bonded by Napoleon III for $6,000,000, and something in the neighborhood of $612,775,000 has already been spent on that system. In this country probably $2,000,000,000 will have to be spent before a proper road system is developed. This, however, does not seem so large when it is divided among the states and spread over a period of ten or fifteen years. New York state has bonded itself for $50,000,000, and $5,000,000 a year is now being expended by that state. New York heads the list of states which have made progress. Georgia is second, and has built 4,344 miles of road in five years. That state employs 4,500 prisoners on the public roads.

HIGHLY SUPERHEATED STEAM*

BY GILBERT E. RYDER.

From the service results that have been obtained with superheaters on locomotives, it is conservative to place the saving effected in the fuel consumption under average working conditions at 25 per cent. This saving is so large that we are liable to overlook the significance of the fact that it really means an increased hauling capacity of 33⅓ per cent. For example, assume that we are burning 6,000 lbs. of coal per hour in a saturated steam locomotive, and that this is the limit of the fireman's capacity. Assume also that the economy of the entire locomotive is such as to obtain one horse power hour with each 4 lbs. of coal. Under these conditions 1,500 horse power hours are being developed. Now suppose that the same locomotive is equipped with a superheater which permits the saving of 25 per cent. in fuel; that is, the consumption is 3 lbs. of coal per horse power hour, or 1,500 horse power hours with 4,500 lbs. of coal. But the capacity of the fireman was assumed to be 6,000 lbs. of coal per hour. In firing 6,000 lbs. of coal per hour with the superheater locomotive, 2,000 horse power hours are developed, an increase of 500 horse power hours, or 33⅓ per cent. This increase of 33⅓ per cent. in horse power hours means an equivalent increase in hauling capacity, which is the real thing of importance to the railway mechanical and operating departments, inasmuch as it means a decrease in the investment in power and a corresponding decrease in the operating costs to handle the same amount of traffic.

Dry or moderately superheated steam has been frequently tried, but with little economy compared with the remarkable results obtained with a high degree of superheat. The smoke box type is open to serious objection in that it obstructs the front end. Furthermore, in some designs there is a high cost of maintenance due to the corrosion of the pipes and their deterioration occasioned by the abrasive effect of the cinders. These mechanical defects have not been so instrumental in the abandonment of this type of superheater, however, as the small economies obtainable by the low degree of superheat which they produce.

The fire tube superheater, by the use of which the temperature of the steam entering the cylinders is from 600 to 650 deg., or a superheat of from 200 to 250 deg., has been almost universally adopted by railways using superheated steam, because of the largely increased efficiency of the locomotives using such high degrees of superheat. At present there are over 12,000 locomotives in the world equipped with fire tube superheaters furnishing highly superheated steam. Over 2,000 of these are in service in the United States.

The principal advantages secured through the use of highly superheated steam are occasioned by the increased volume of steam delivered per pound of water evaporated and the prevention of cylinder condensation. The economy which results from the use of the superheater is largely due to the reduction of what is known as the "missing quantity" or the difference between the actual steam passing through the engine and that which is shown by the indicator card. This quantity is largely due to the loss by condensation in the passages and in the cylinders.

Saturated steam has the same temperature and pressure as the water from which it is evaporated and with which it is in contact in the locomotive boiler, and for each pressure the steam has a certain constant temperature. At 170 lbs. boiler pressure, for example, the steam will always have a temperature of 375 deg. F. and a volume of 2.47 cu. ft. per pound. If more heat is added to the boiler it is transmitted to the water and is used in evaporating more water, but does not increase the steam temperature as long as the pressure remains the same. If heat is taken away from the saturated steam in doing work or by cooling, as in the steam passages of the cylinders, part of the steam condenses. The amount of the steam condensed is almost proportional to the heat abstracted and this condensed steam, or water, is inert so far as the capacity for further work is concerned. The greatest loss from condensation occurs in the cylinders, for here the variation in temperature is widest and the large areas offer a favorable condition for the loss of heat or for condensation to take place.

Tests show that in Mallet compound locomotives without superheaters, the condensation in the receiver pipe runs up to over 20 per cent., while in simple saturated engines using a short cut-off it runs up to over 35 per cent. of the weight of steam admitted to the cylinders; that is, for every 100 lbs. of steam delivered to the cylinder only 65 lbs. are available for doing work. This loss as stated above, can be overcome by the use of highly superheated steam, and means an average reduction of 35 per cent. in the amount of water used and of 25 per cent. in the amount of coal used per ton mile.

Let us now consider the qualities of superheated steam. When steam has left the boiler and passed into the superheater it is no longer in immediate contact with the water from which it was generated. If heat is now added to the steam in its passage through the superheater tubes and moisture is first evaporated and the additional heat is absorbed by the steam, so that on reaching the high pressure steam chest it has a temperature of about 200 deg. F. above that which it had when leaving the dry pipe, meaning that it reached the high pressure steam chest at

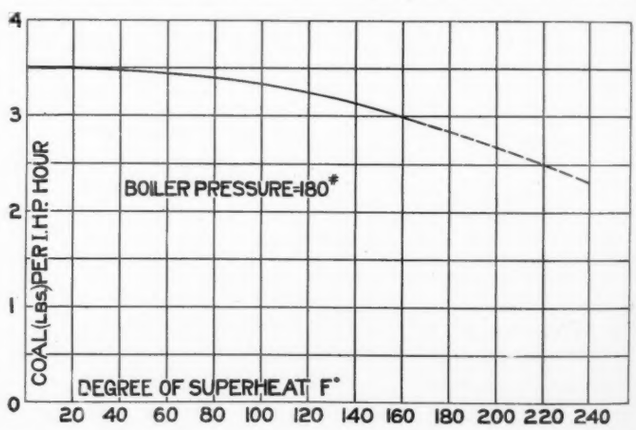


Fig. 1—Coal Used per Indicated Horse Power Hour for Different Degrees of Superheat.

an actual temperature of about 600 deg., instead of 390 and 400 deg., as would be the case with a saturated steam engine. The pressure of the superheated steam, however, is practically the same as in the boiler.

Superheated steam approaches the condition of a perfect gas. It has a larger volume per unit of weight than saturated steam, and like a gas, is a poor conductor of heat, giving up its heat to the cylinder walls and steam pipes less rapidly. Take a case of superheated steam at 170 lbs. pressure with 200 deg. F. superheat. It has a volume of 3.27 cu. ft. per pound, as against 2.47 cu. ft. per pound for saturated steam. Of course, when superheated steam passes from the superheater to the comparatively cold cylinder walls some of its superheat is given up to these walls and the passages traversed in reaching the cylinders, but the condition differs from that of saturated steam in that it does not condense until it has lost all of its superheat.

The curve in Fig. 1 shows the saving which is effected in the pounds of coal per indicated horse power hour for various degrees of superheat. It will be noted that from 0 to 160 deg. of superheat a saving of one-half pound of coal per indicated horse power hour was effected while this same saving was again effected in the next 60 deg. of superheat.

The effect of the superheater on the boiler is to increase its capacity from 25 to 35 per cent. in proportion to the decrease in

*Abstract of a paper presented before the Southern & Southwestern Railway Club, January 18, 1912.

the demands that are made on it. It has been shown that as the demand for power is increased the degree of superheat increases so that the demand on the boiler does not increase in proportion. It is, therefore, economical to force a superheater engine, while it is not economical to force a saturated boiler in the same way, and it is, many times, impossible to do so for any length of time. The fact has been proved that locomotives equipped with superheaters developing high degrees of superheat have at least 25 per cent. greater boiler capacity than the same size of engine without a superheater. As the engine is worked harder, the fire is forced, which means a higher fire box temperature and hotter gases in the superheater. This results in a higher temperature of the steam, and with this higher superheat we begin to get the greater efficiencies which are characteristic of the superheated steam locomotives when they are worked hard.

In engines operating in poor water districts where foamy water and fluctuations in water level would tend to increase the amount of water carried over from the boiler, it may readily be seen that a device which reduces the demand on the boiler, and which will in addition prevent the water from reaching the steam chest and cylinders, will greatly lengthen the life of the valves and pistons, prevent breakage of the cylinder heads from water pressure, and also lengthen the life of the boiler. Another feature which favors the boiler in the use of superheated steam is the comparatively low boiler pressure which may be carried. The size of the cylinders is not limited, as in the saturated steam engines, where the diameter of the cylinders must be limited in order to reduce condensation. Standard recommendations for boiler pressures to be used in connection with superheaters are 180 lbs. for freight engines and 200 lbs. for passenger engines. In bad water districts even lower boiler pressures may be used with correspondingly enlarged cylinders.

The requirements for an efficient and practicable fire tube superheater may be summed up as follows: An integral header which is out of the way, in no way obstructing the front end or interfering with the maintenance of the boiler tubes, and so designed as to cause the least tendency toward wire drawing of the steam; the superheater pipes should be easily accessible and

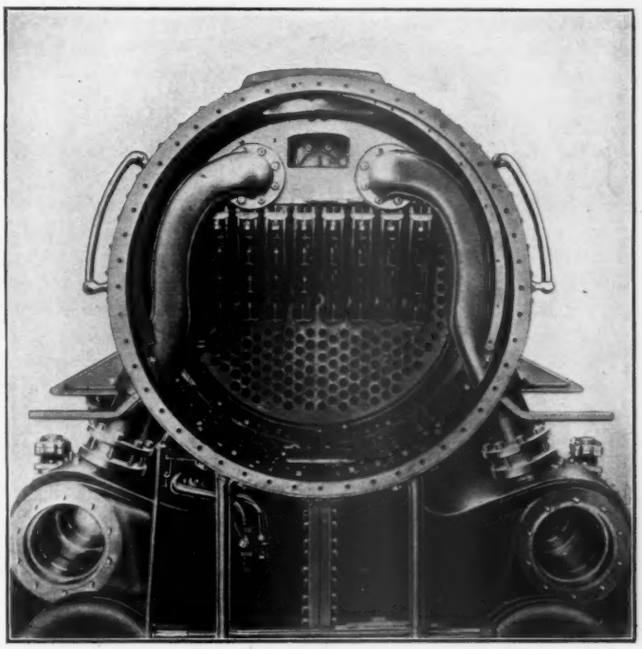


Fig. 3—Front End Arrangement with a Fire Tube Superheater and Outside Steam Pipes.

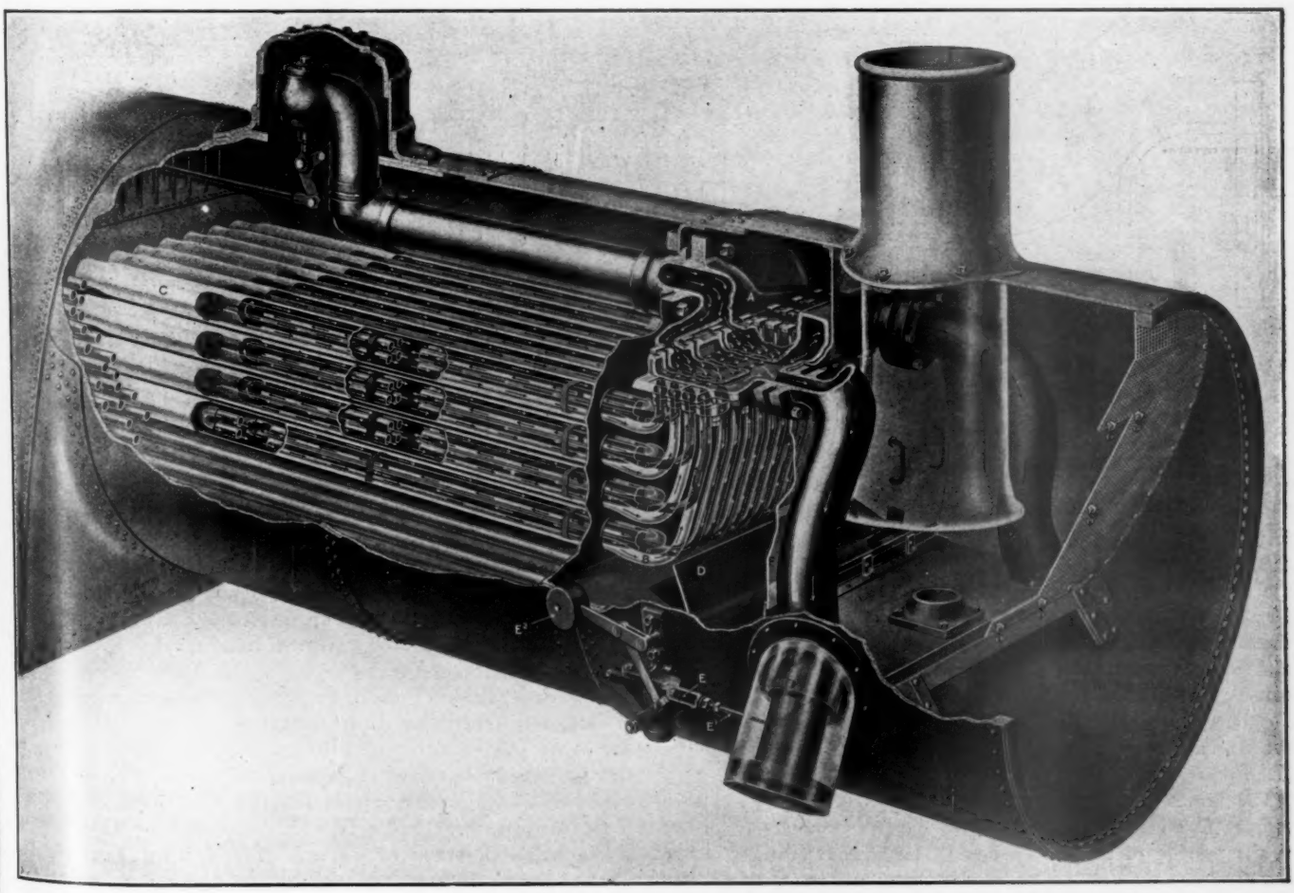


Fig. 2—Top Header Fire Tube Superheater.

removable, and so constructed that the unequal expansion caused by the difference in temperature as the steam passes through the tubes will be taken care of; the superheater flues should be located in the upper part of the boiler, where the tendency toward clogging is least and the temperature is highest. These points have been carefully provided for in a superheater which will be shown in the accompanying illustrations.

The superheater assembled, Fig. 2, consists of a header *A* supported on brackets in the smoke box and making a joint with the steam pipe in the same manner as the tee head used in the saturated engines. Attached to the header and in communication with it are the coils or units *B* made up of cold drawn seamless steel tubing and screwed into return bends. Each unit is located inside a large flue *C*, and extends to within about 2 ft. of the back flue sheet. The large boiler flues are set into the front and back flue sheets in very much the same manner as the ordinary small boiler tubes.

The tools which have been found to give satisfactory results in setting the large flues are a flue roller, consisting of five rollers, and a prosser or expander made up of twelve sections. The recommended method of setting the flues employs a copper ferrule in the fire box end; the rolling, prossering and beading of the flue on the fire box end; and the rolling and beading of the flue in the front end. In the introduction of the copper ferrule it is advisable to break the corner of the hole in the tube sheet on the outside of the sheet in order to remove any burr that may be left by the cutting tool, and also to remove the tendency of the sharp corner cutting into the flue. In beading the flues the beads should be carefully turned down against the sheet. In the maintenance of the flues, the prosser should be given preference.

The flow of gases through these tubes is controlled by a damper *D*, which is operated by the damper cylinders *E* located at the outside of the smoke box. The normal position of the damper is open when the locomotive throttle is open, thus allowing the gases to pass through the large tubes and come in contact with the superheater units. The deflecting plate *F* is in a vertical position, and this in connection with the horizontal partition, which extends from the deflecting plate to the front flue sheet and contains the damper, makes the complete enclosure for the header and the part of the superheater units which extend through the front flue sheet into the smoke box. The deflecting plate is made in parts to be easily removable. The operation of the superheater is as follows: When the throttle valve is open saturated steam passes through the dry pipe and into a portion of the superheater header designed to receive the saturated steam. From this portion of the header, which is in communication with one end of the superheater units, the steam passes downward through one tube of the unit, backward toward the back flue sheet, forward and backward again, and then forward and upward to the other side of the header designed to receive the superheated steam. From the header it then passes into the steam pipes, then into the steam chest and into the cylinders.

A detail view of the header casting through several sections is shown in Fig. 4. The passageway marked *S* represents the superheated and that designated *W* the saturated steam passageways, which are in communication with the respective chambers marked *S* and *W* in the section *CC*. The units shown in Fig. 5 are held in place by a bolt which extends through slots in the header casting between the superheated steam and saturated steam chambers, and are prevented from turning by bosses or lugs located at the top facing of the header. The section through *BB* shows a section of one of the top steam pipe connections, and is similar in other respects to section *AA*. In the plan view of the lower side of the casting is also shown a part cut away to indicate the arrangement of the saturated and superheated steam chambers and the direction of the flow of the steam through their passages.

The ball connections of the units, Fig. 5, are each ground to fit the seats in the header casting and are clamped to the header. This clamp is supplemented by a ball ring fitting under the ball

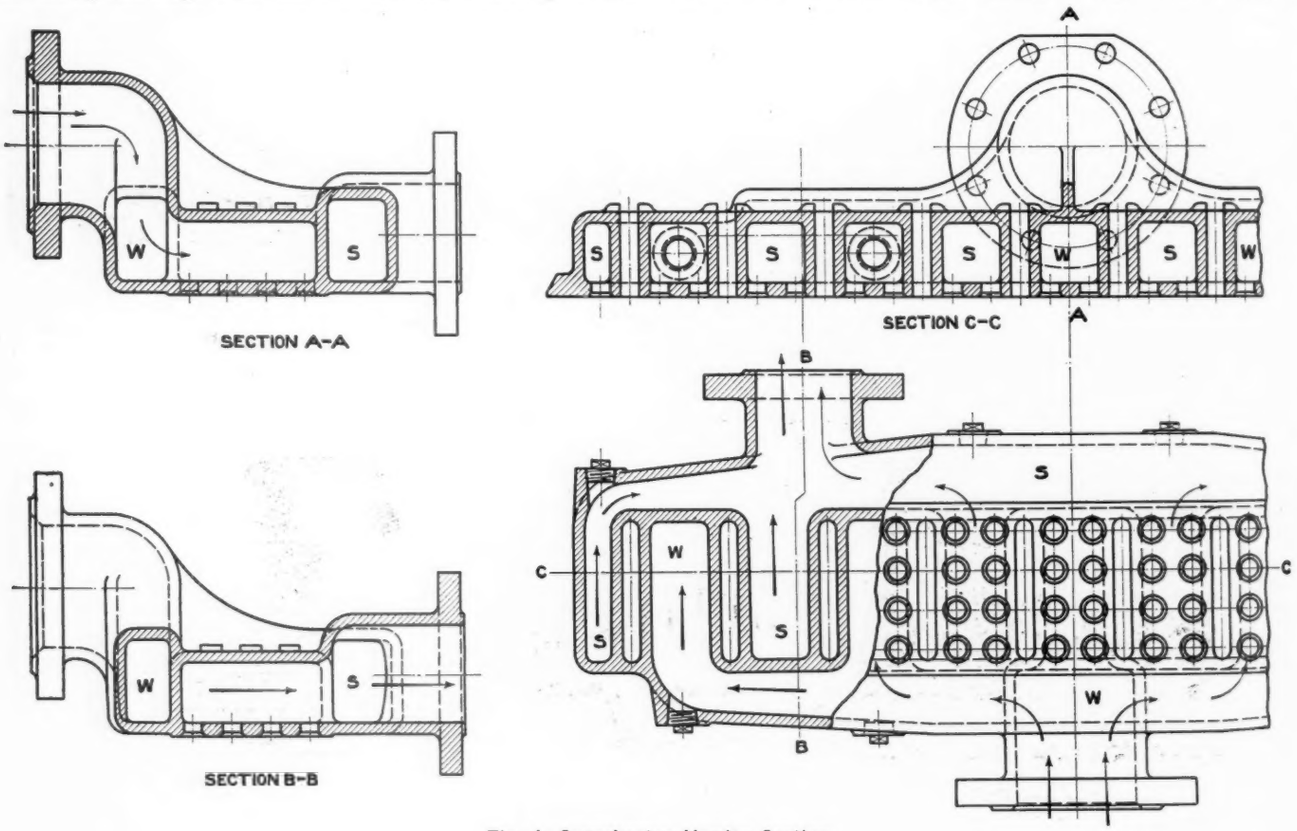


Fig. 4—Superheater Header Casting.

of the tube in a manner that will provide for any irregularity that may occur in the ball heads or in the depth of the seat in the header. The return bends are of cast steel and are provided with lugs which rest against the inside of the large flues and keep the superheater units in the upper part of each flue.

The superheater tubes may be easily removed and replaced, and in doing this it is not necessary to take down the steam pipes.

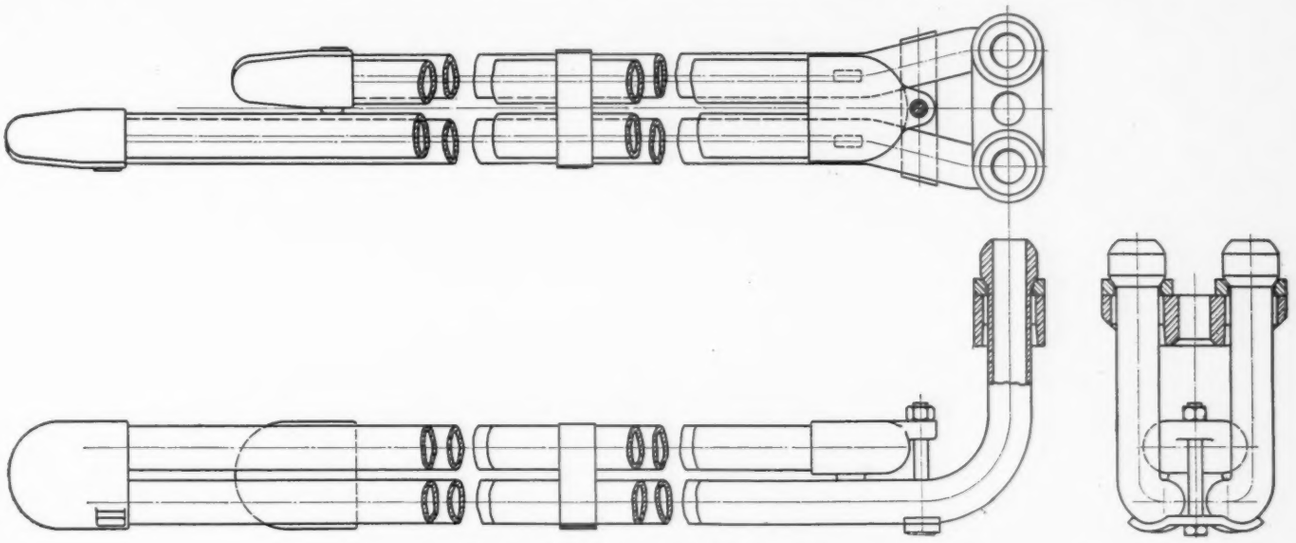


Fig. 5—One of the Superheater Units.

It is also possible to thoroughly inspect the front end, and do all necessary work on the boiler flues, boiler tubes and the front tube sheet seam, without the necessity of taking down the superheater header or the steam pipes. A hand hole opening is usually provided on the smoke box sides, through which inspection may be made of the entire front end of the superheater by the aid of a light, without taking down the front end netting or even opening the smoke box door.

The front end arrangement of the superheater applied in connection with the outside steam pipes is shown in Fig. 3. It clearly shows the convenience of the outside steam pipe arrangement, which is being applied quite generally to superheater locomotives. This arrangement places the two lower steam pipe joints outside the smoke box, making it easy to locate leaks in these joints, should any such occur; when these leaks do occur they do not affect the steaming quality of the engine as in the case of steam pipe joints located inside the smoke box. Another advantage in their use is the absence of stress and heat interchanges in the cylinder saddle caused by the difference in temperature of the live steam and exhaust steam on opposite sides of the same wall. Outside steam pipes also offer a greater clearance in the lower part of the smoke box affording better opportunity for drafting the engine, and making the operation of cleaning the front end very much simpler.

The introduction of the outside steam pipes also greatly simplifies the construction of the cylinder casting. It eliminates the steam passageway in the saddle, leaving only the exhaust passage. It also reduces the weight of the cylinder casting and simplifies the coring.

The joint rings between the steam pipes and the header, and the steam pipes and the cylinders should be made of cast iron;

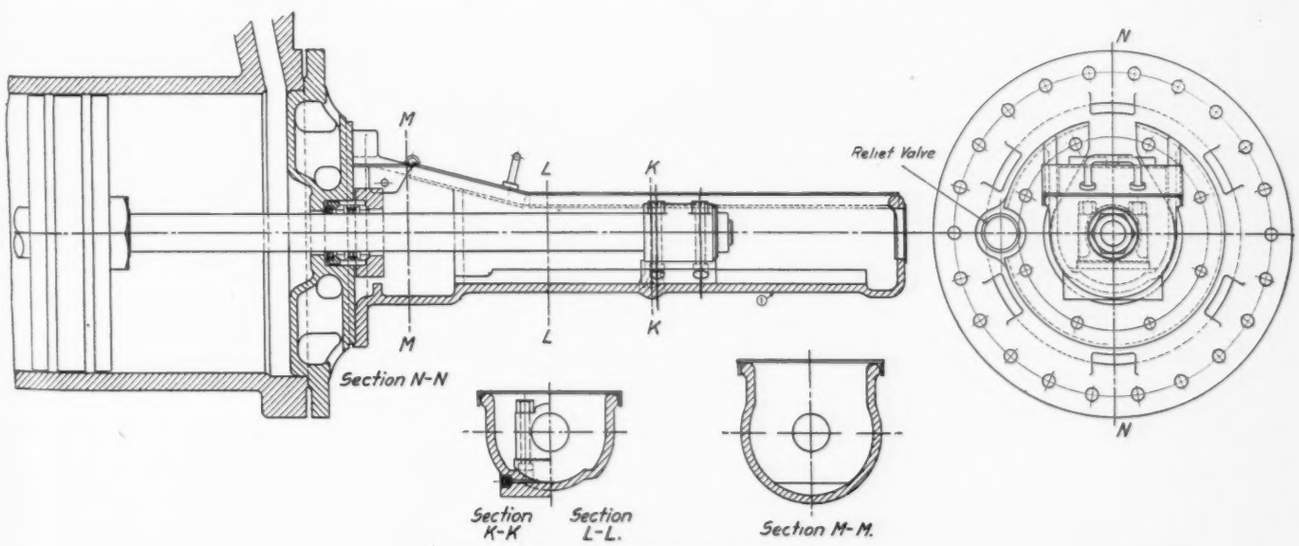


Fig. 6—Piston Rod Extension and Guide.

brass rings will not stand the high temperature on account of disintegration. Piston valve rings and piston rings and bushings should be close grained cast iron, and too much attention cannot be given to the quality of material of these parts. The ordinary designs of piston rod packing have given satisfactory service, but the alloy used for the packing rings should have a higher melting

point than usual in saturated engines. An alloy of 80 per cent. lead and 20 per cent antimony has given satisfaction.

An essential requirement in connection with the superheater locomotive is the use of good oil and continuous lubrication. The system found to be best adapted for a simple two-cylinder engine is a five-feed lubricator, the leads to extend into the steam pipes or the center of the steam chests and into the centers of the cylinders. The fifth feed to lead into the air pump steam pipe in the ordinary manner. The feeds to the steam chest should enter the center of the steam chest and should not be branched off. The steam chest should get three or four drops of oil for each drop fed to the cylinder. Vacuum valves of ample size on each steam chest are more essential in a superheater engine than in ordinary engines. While the engine is working steam, the oil is sufficiently protected by the steam against carbonizing. While drifting, however, the oil has no such protection, and on account of the high temperature of the steam chest walls would have a tendency to carbonize, which can be overcome by the vacuum valves letting the cold air in. For similar reasons it is recommended that drifting valves be used, or at least to crack the throttle at the beginning of a long stretch of drifting.

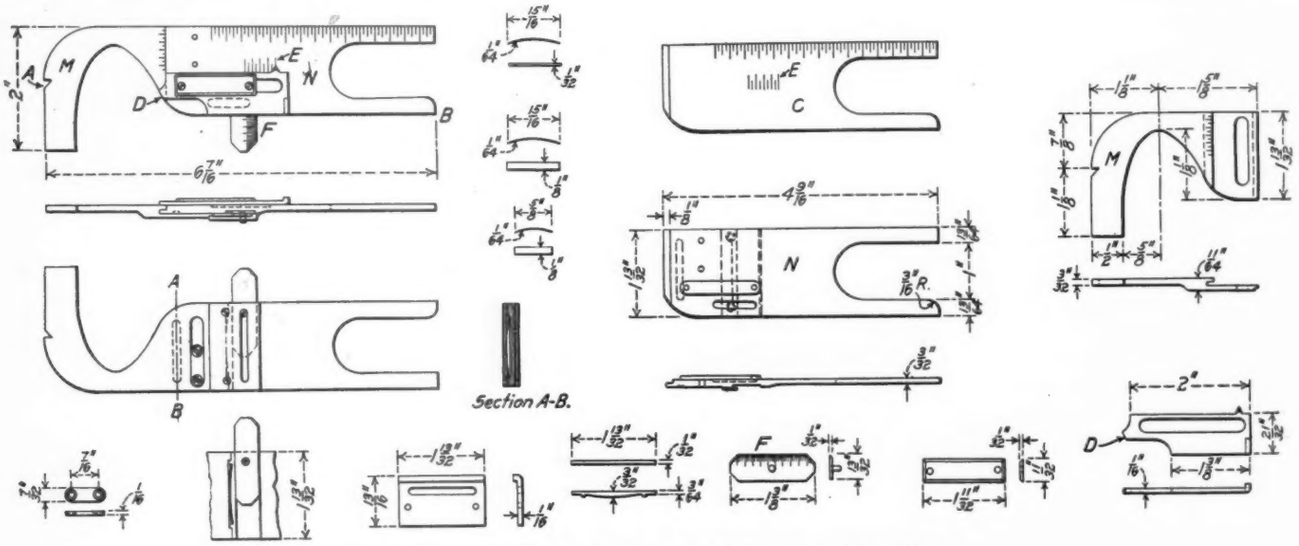


Fig. 1—Tire and Flange Gage for Driving and Trailing Wheels.

The piston rod extension, Fig. 6, was also found to be of considerable value in reducing the wear of cylinder bushings and cylinder packing rings. The one illustrated was designed by F. J. Cole, chief consulting engineer of the American Locomotive Company. The extended rod riding on guides relieves the cylinder bushings and rings from the weight of the piston, and thereby reduces the friction and the wear on them. A piston rod extension to be satisfactory must be of simple yet rigid construction, easy to lubricate and easily removed without interfering with other parts of the locomotive; above all, it must have an ample bearing surface, a feature which was lacking in all of the earlier designs of piston rod extensions.

A superheater can be successfully applied to any of the existing types of locomotive, provided they are equipped with piston valves. By this application the boiler capacity will be increased 25 per cent., and it will be possible to haul correspondingly heavier trains on the same schedule, or the same trains on a proportionately faster schedule. It has been found in many cases that trains double headed with saturated engines could be handled with one superheater engine. The boiler maintenance is also reduced in that it is possible to reduce the boiler pressure if the construction of the cylinders is such that their diameter may be increased. By increasing the size of the cylinders without decreasing the boiler pressure the engine is given a greater starting power and the increased boiler capacity will more than take care of the demands of the larger cylinders for steam.

ENGINE HOUSE KINKS

BY C. C. LEECH.*

TIRE GAGE.

A convenient gage that may be used for measuring the wear on either the tread of a tire or its flange is shown in Fig. 1. It is made up of the principal parts, *M* and *N*. Part *M* is cut out to the exact contour of the flange of a tire as it should be when first placed in service. Part *N* contains the different gages for measuring the depth of wear on the tread and the wear on the flange. The application of the gage is illustrated in Fig. 2. To measure the thickness of the flange the gage is applied with the hook fitting snugly over the flange and the gaging point *D* is moved against the flange. The amount of wear is indicated on the scale *E*, which is divided into divisions 1/16 in. apart.

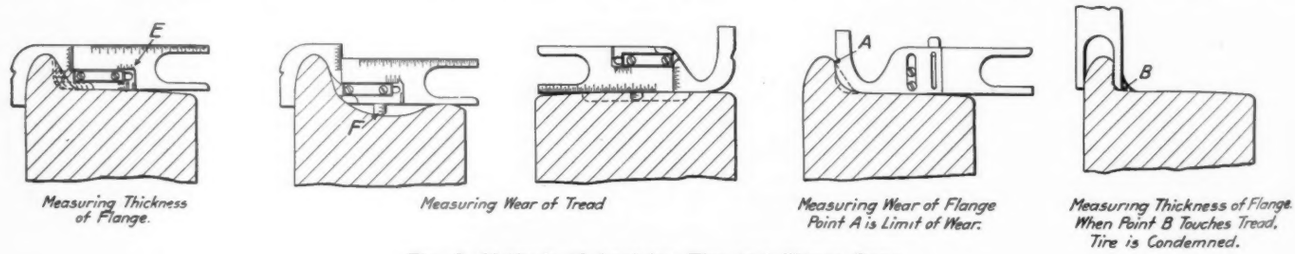

Measuring Thickness of Flange.
Measuring Wear of Tread
Measuring Wear of Flange Point A is Limit of Wear.
Measuring Thickness of Flange. When Point B Touches Tread, Tire is Condemned.

Fig. 2—Methods of Applying Tire and Flange Gage.

The depth of wear of the tread is measured by the scale *F*, which is free to slide up and down in the part *N*. The limits of flange wear may be determined by using the gage as shown

*These kinks are taken from Mr. Leech's contribution to the *Railway Age Gazette* shop kink competition of September 15, 1911.

in the two right hand views in Fig. 2. The details of the gage are clearly illustrated in Fig. 1. All the sliding gages are held in position by flat springs 1/64 in. thick. All scales are divided into 1/16 in. spaces, except the one that measures the wear of the tread, which is divided into 1/32 in. spaces.

CRANK PIN TRUING MACHINE.

Locomotive crank pins often wear out of round and it is an expensive and troublesome proposition to remove them from the wheel center to be trued up. The machine shown in Fig. 3 is applied to the crank pin without removing it from the wheel center. It consists of an iron frame *F*, which is fastened to the pin near the wheel center by an arrangement somewhat similar to a steady rest used on lathes. The other end is held in position by a hardened steel center, fitting into the center of the crank pin. Small guides *G* are arranged on the yoke *C*, to fit over the collar on the end of the crank pin, and in this way keep the apparatus from slipping off. The tool is located on the cross arm of the frame and is adjusted by a feed screw operating through a small vertical yoke. The tool is fed by a lead screw, which is held in bearings on the frame. The tool is driven by the handle *H*, which swings the whole apparatus around the crank pin, the steady rest being carefully adjusted to prevent any irregularity while being turned. The feed is accomplished by a belt operating on a pulley on the handle *H* and one on the end of the lead screw. The direction of the feed may be changed by using a straight in place of a crossed belt. When the crank pin collar does not project beyond the face of

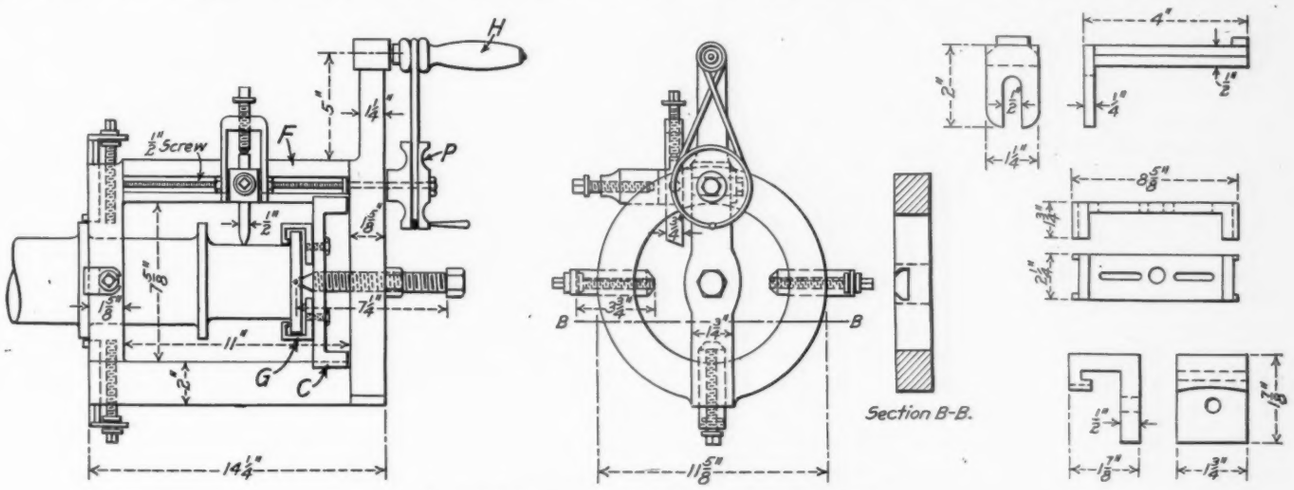


Fig. 3—Hand Driven Machine for Truing Crank Pins.

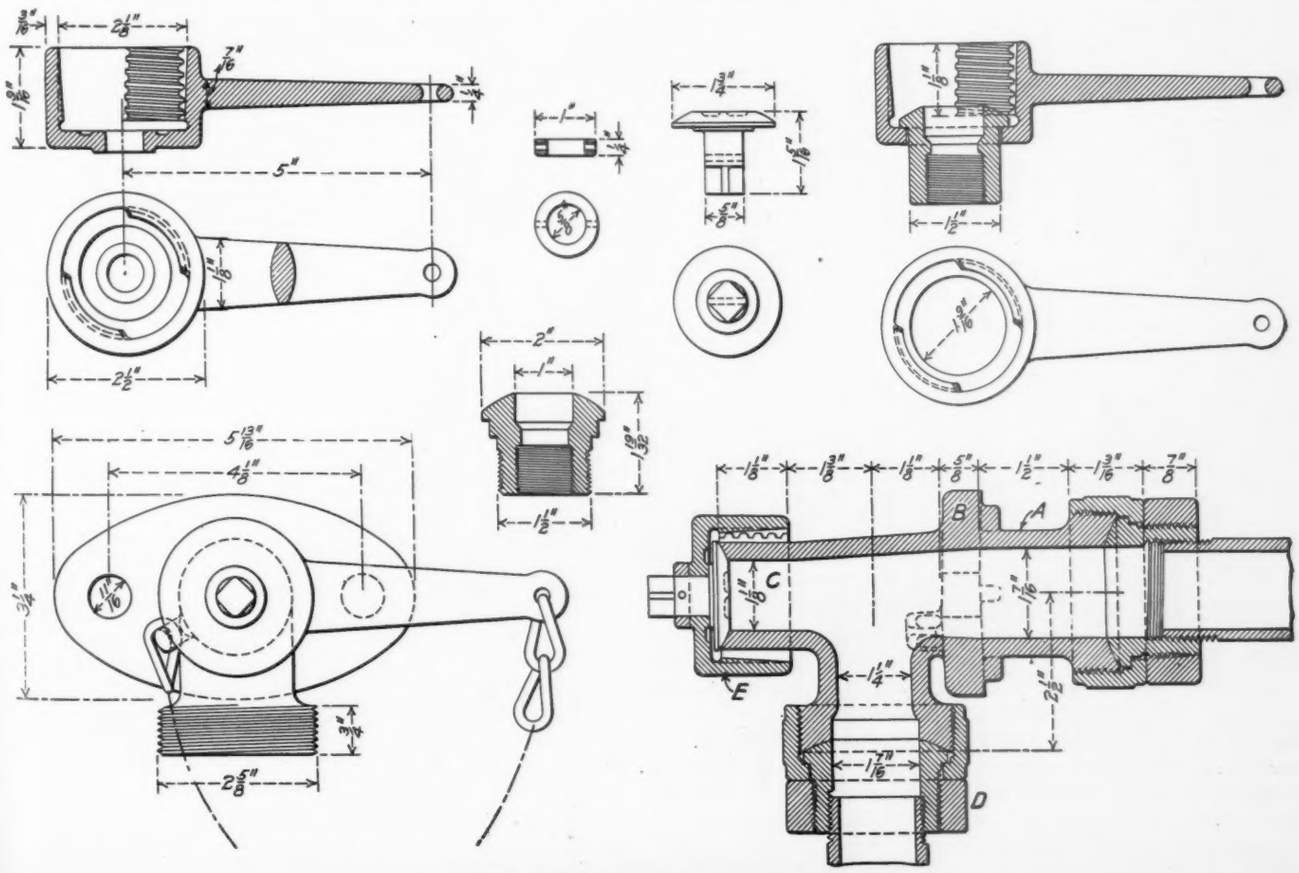


Fig. 4—Smokebox Connection for Blower.

the wheel hub, allowing no shoulder for the steady rest jaws to rest on, a ring is provided about ¼ in. x ¾ in. in section. This is temporarily fastened on the wheel hub by three countersunk head screws. This machine has been found very serviceable and an entire set of pins on a consolidation locomotive can be gone over in 15 hours at a small cost when compared with the cost of renewal.

SMOKEBOX BLOWER CONNECTION.

A simple form of blower connection for raising steam when firing up locomotives in the engine house is shown in Fig. 4, which illustrates the details of a standard blower ell to be appiled to all locomotives. The part *A* extends inside the smokebox and provides a union connection for the blower pipe to the stack. The flange part *B* is bolted to the smokebox from the outside. Two connections are provided for on the outside; the *D* end takes care of the steam line from the locomotive boiler, and the *C* connection may be connected to the steam blower hose in the engine house, and is used to raise steam when the fire is started. This *C* end has a coarse thread and when not in use is covered by the cap nut *E*, which has a handle and is chained to the flange *B*. The details of the handled nut connection that fits *C* upon removal of cap *E*, and to which the steam hose is attached, is also shown. This device has been used successfully where engines are fired up with crude oil and soft coal.

REFUSE AND CINDER CAR.

If the engine house and the surrounding yard are to be kept in good condition laborers must be constantly employed wheeling out the cinders and sweepings. The car shown in Fig. 5 has been found very serviceable for such work. It is made of a heavy oak frame which is carried on two pairs of wheels of standard gage. The car is run into the house, or wherever needed about the yard, and dirt, cinders and refuse are thrown into it, saving the labor of loading up small wheel barrows and wheeling the load to a dump car, usually a long distance away. When the bucket is full the car is pushed over the ash pit; the bucket is lifted from the car and by special mechanism of the ash pit pneumatic hoist it is carried over and the contents dumped into the cinder car. The bucket is made in two parts, hinged at the points *A*. The fastening of these two parts is such that they may be opened out by an attachment on the hoist when the bucket is over the cinder car. The capacity of the bucket being about a cubic yard, the dumping need only be done twice a day at the most, and usually only once.

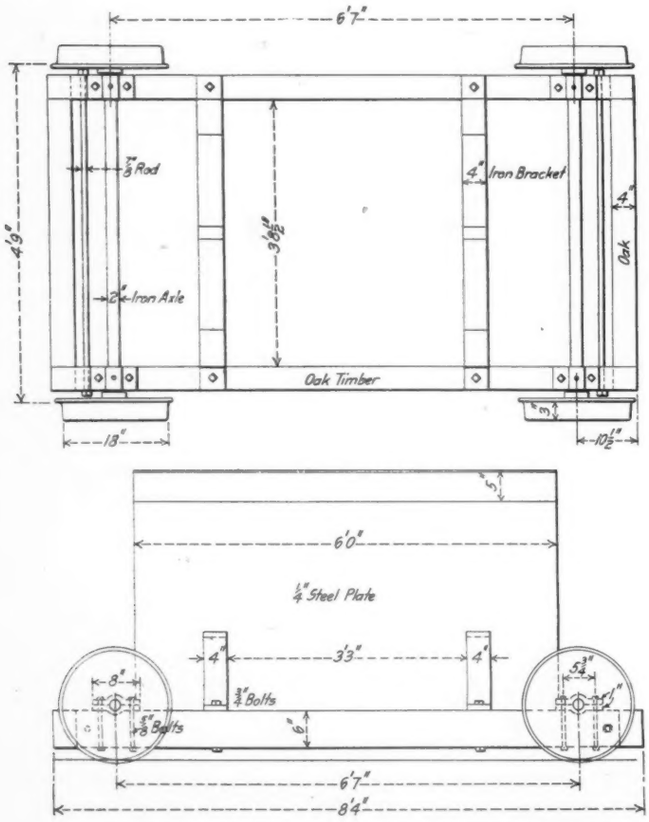


Fig. 5—Standard Gage Cinder Car for Shop and Yard Use.

MOLD FOR TINING CROSSHEAD SHOES.

The mold shown in Fig. 6 is used for tining crosshead shoes. It may be made of either cast or wrought iron and is divided into three parts, *A*, *B* and *C*. As will be noted in the end view, the part *B* slides in grooves in the parts *A* and *C*, and the various parts are held together by dowel pins located in *A* and *C*, which slide in grooves in the tongue of *B*. At the left hand end of the mold two studs are set in the parts *A* and *C*, which hold the guide bar *D* by lock nuts. A lead screw runs through this guide and is held to the part *B* by a collar *F*, which is free to turn. As this screw is turned *B* is moved in or out, as the case may be, and as it moves the outside blocks *A* and *C* are drawn in or out by the dowel pins. After the lining has been cast the mold can be easily removed.

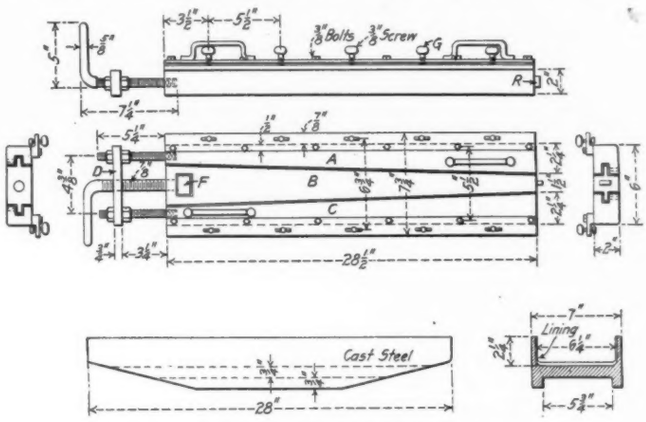
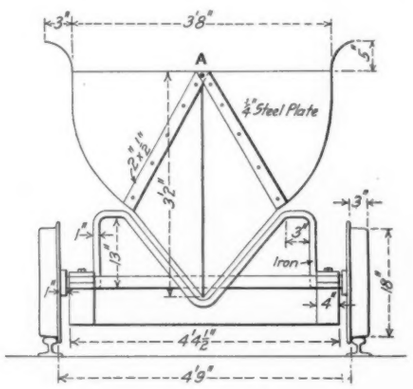


Fig. 6—Mold for Tining Crosshead Shoes.

The thickness of the babbitt metal is regulated by the thumb screws *G*, which rest on the sides of the crosshead shoe and regulate the distance the mold extends into the shoe. Two handles are provided to facilitate carrying the molds. The crosshead shoe is held on the frame work shown in Fig. 7. It consists of a bar iron frame fastened to a ⅞ in. plate, 25 in. long by 11¼ in. wide. This plate is pivoted at *H* on the end of a bench or table as shown in Fig. 8, and is held in a hori-



zontal position by a bracket *K*, which is held on the leg of the table so that it may be swung under the frame. Three brackets, *J*, made of 1⅜ in. x ⅜ in. bar iron are fastened to the bottom plate. A yoke is located directly above the hinge, and has a screw clamp through its cross arm for holding the mold and

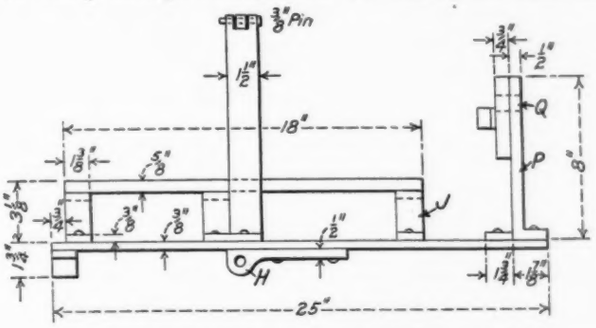


Fig. 7—Frame for Holding Crosshead Shoe and Mold.

crosshead in position in the frame. The cross arm is hinged at *L* and is locked by a pin at *M*. A back rest is located at the right hand end of the base of the frame and is supported by the arm *P*. It has a small hole *Q*, ¾ in. x ⅜ in., which receives the projection R on the end of the mold. Two brackets are fixed on this end rest which center the shoe on the frame work.

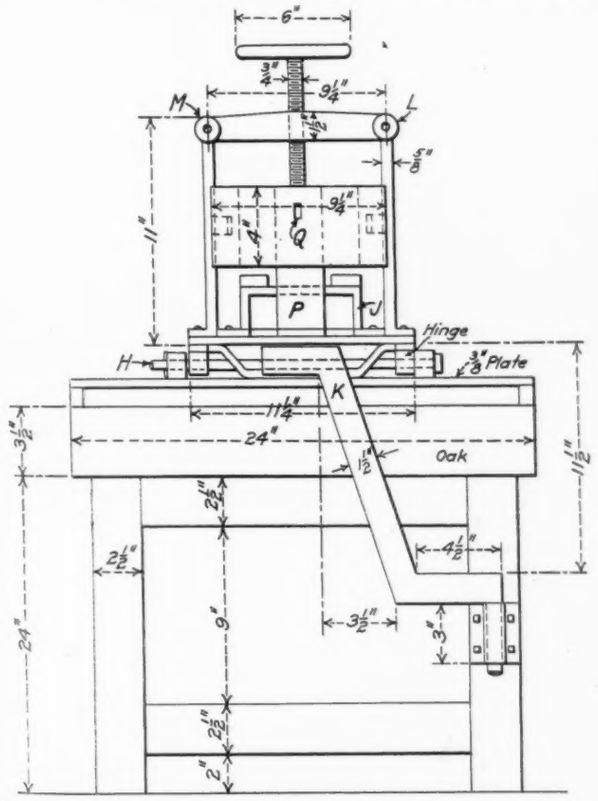


Fig. 8—End View of Apparatus Used for Tining Crosshead Shoes.

After the mold and shoe have been put in place and clamped in position the bracket arm *K* is swung from underneath the frame and the whole arrangement is allowed to swing into a vertical position. The mold is then ready for filling, the opening between the shoe and the back stop being covered with asbestos to prevent the metal from escaping. The metal is poured in at the top, the mold and shoe of course having been sufficiently heated; when the metal has cooled the device is swung back on to the table in a horizontal position and the part *B* of the mold is slightly drawn out by the lead screw, at the same time drawing the parts *A* and *C* away from the sides of the shoe, allowing the mold to be removed.

HEAVY FREIGHT AND PASSENGER LOCOMOTIVES

Another instance of the efforts being made by the railways to reduce operating costs by the introduction of locomotives of greater capacity and higher efficiency in operation is furnished by the new motive power recently put into service on the Buffalo, Rochester & Pittsburgh. This consists of three Pacific type and seven Mikado locomotives built by the American Locomotive Company. Each of the two classes rank among the more powerful locomotives of its type, and both are equipped with superheaters and brick arches with the view of securing greater economy in operation.

As is shown in the accompanying comparative table of dimensions, a comparatively light class of power has been used in both freight and passenger service on this road. The heavier engines have been purchased to make it possible to increase the train loads on the most difficult sections of the road. Freight traffic is at present handled chiefly by consolidation locomotives, having a total weight of 193,000 lbs., and a maximum tractive effort of 38,660 lbs. In passenger service an Atlantic type

	Passenger.		Freight.	
	4-6-2	4-4-2	2-8-2	2-8-0
Weight on drivers, lbs.....	163,500	106,200	216,500	171,600
Weight, total engine, lbs.....	258,000	183,600	273,500	193,000
Weight, engine and tender, lbs.	427,300	305,100	443,300	323,750
Tractive effort, lbs.....	36,300	26,700	51,130	38,660
Cylinder, diam. and stroke, in.	24½ x 26	20½ x 26	26½ x 30	21 x 28
Driving wheels, diameter, in...	73	73	63	57
Boiler pressure, lbs.....	200	210	180	210
Boiler diameter, in.....	74	70⅛	74	70⅛
Firebox, length and width, in..	108 x 75¼	107 x 73¼	108 x 75¼	107 x 73¼
Tubes, number and diameter, in.	240—2	333—2	240—2	354—2
Flues, number and diameter, in.	32—5⅜	.....	32—5⅜	.....
Tubes, length, ft. and in.....	20-0	15-9¼	20-0	14-6⅛
Heating surface, tubes, sq. ft...	3,395	2,733	3,395	2,672
Heating surface, firebox, sq. ft.	240	183	240	176
Heating surface, total, sq. ft...	3,635	2,916	3,635	2,848
Superheating surface, sq. ft....	*757	.....	*757	.....
Grate area, sq. ft.....	56.5	54.4	56.5	55.5
Wheel base, driving, ft. and in.	13-0	8-0	16-6	16-0
Wheel base, engine, ft. and in.	33-3	29-2	34-9	24-6
Wheel base, engine and tender, ft. and in.	65-11	56-9	67-4¼	55-11

*Figured on the basis of the inside diameter of the superheater tubes.

locomotive with a total weight of 183,600 lbs., and a maximum tractive effort of 26,700 lbs. is used.

For freight movement the most difficult section of the road lies on the main line between Clarion Junction, Pa., and Freeman. This section consists of a seventeen-mile grade averaging 0.85 per cent., with a maximum of 1.24 per cent. The most severe conditions are at a portion of the road where 8 deg. reverse curves occur on a 1.11 per cent. grade. At present a consolidation with a 2-10-0 type locomotive as a helper takes a train of 1,850 adjusted tons over the grade at a speed of 10 miles per hour. The rating of the consolidation alone on this grade is 750 tons.

The new Mikados are designed to haul 1,100 tons, or a 46.6 per cent. heavier load than the consolidations, up the grade at the same speed. This will increase the present maximum train load over the division from 1,850 to about 2,250 adjusted tons, an increase of nearly 22 per cent.

In fast passenger service the most difficult section is an eight-mile grade between Howard, Pa., and Bingham averaging 1.37 per cent., with a maximum of 1.5 per cent., combined with 8 deg. curves uncompensated. The schedules of the fastest trains require an average speed of thirty miles per hour up this grade. Present passenger traffic conditions compel the operation of trains of 6 or 7 steel passenger coaches of a total weight of from 400 to 460 tons. With such trains it is beyond the capacity of a single Atlantic type locomotive to make the schedule speed up the grade. The new Pacifics are designed to take a 400-ton train over the maximum 1.5 per cent. grade at a sustained speed of 30 miles per hour.

The existing bridges on the Buffalo, Rochester & Pittsburgh rigidly limit the load on a single axle to 55,000 lbs., and the

problem in the design of both classes of locomotives was, therefore, to provide a maximum capacity within the limitations of weight.

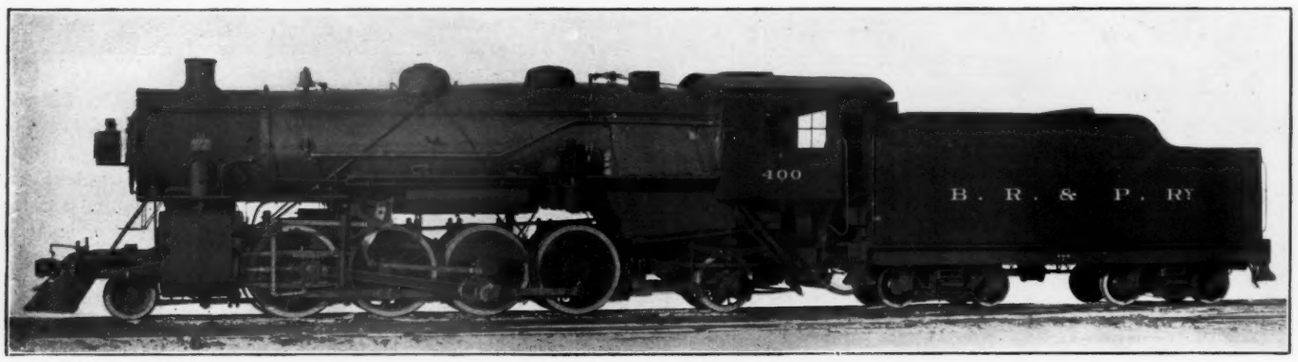
In the case of the Mikado locomotives a theoretical maximum cylinder horse power 36.3 per cent. greater than that of the present consolidations has been secured. At the same time the increase in total weight on driving wheels is only 26 per cent. Calculated on the same basis the Mikados provide a maximum capacity of 2,100 horse power and the consolidations only 1,543 horse power. The Mikados have a weight on drivers of 216,500 lbs., and the consolidations 171,600 lbs. The factor of adhesion provided in the Mikado design is, of course, a little less than in the case of the consolidations. Both, however, are well within the limits of good practice.

Conservatively estimated, it will require an evaporation per sq. ft. of heating surface per hour of not more than 12.4 lbs. of steam at 180 lbs. pressure to develop the maximum cylinder horse power of the Mikado, as compared with at least 14.6 lbs. at 210 lbs. pressure to give the maximum capacity of the consolidations. This comparison shows the much larger boiler capacity provided in the Mikado type, which is one of the most important advantages of this type of wheel arrangement.

only difference being in the length of the smokebox. In the Mikado type the greater distance between the center of the cylinders and the forward driving wheels required an increase of 6 in. in the distance between the front tube sheet and the center of the cylinders, but in other respects they are practically identical.

Both designs embody the new features introduced by the builders within the past two years—viz., outside steam pipes, self-centering adjustable valve rod crosshead, self-centering guide for the piston rod extension and the improved outside bearing trailing truck.

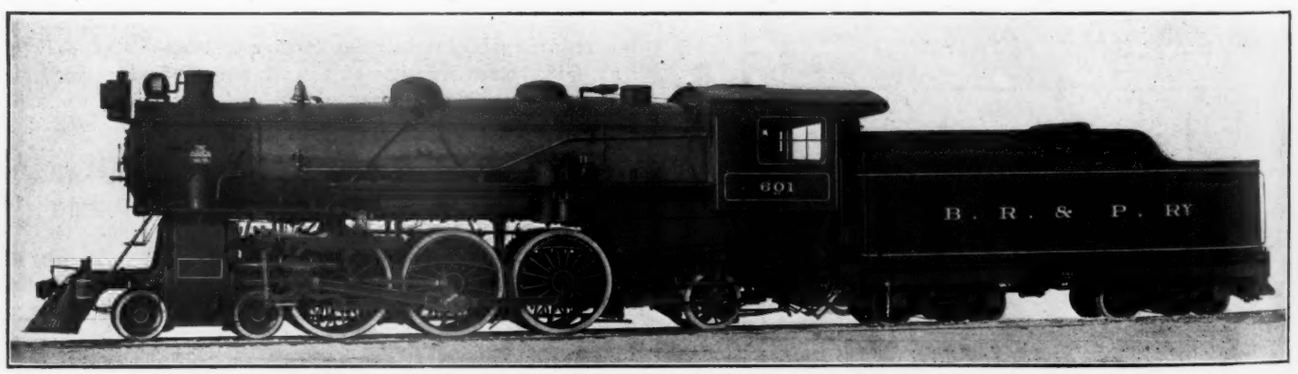
One of the Mikado type locomotives is equipped with a Street mechanical stoker. The general dimensions, weights and ratios of the two types of locomotives are shown in the following table:



Powerful Mikado Locomotive for the Buffalo, Rochester & Pittsburgh.

General Data.

Type	4-6-2	2-8-2
Gage	4 ft. 8½ in.	4 ft. 8½ in.
Service	Passenger	Freight
Fuel	Bit. coal	Bit. coal
Tractive effort	36,312 lbs.	51,133 lbs.
Weight in working order	258,000 lbs.	273,500 lbs.
Weight on drivers	163,500 lbs.	216,500 lbs.
Weight of engine and tender in working order	427,300 lbs.	443,500 lbs.
Wheel base, driving	13 ft.	16 ft. 6 in.
Wheel base, total	33 ft. 3 in.	34 ft. 9 in.
Wheel base, engine and tender	65 ft. 11 in.	67 ft. 4¾ in.



Locomotive Designed to Maintain 30 Miles Per Hour on a 1.5 Per Cent. Grade With a 400-Ton Train.

Likewise, in the design of the Pacific type, the increase in the total weight of engine as compared with the Atlantic is accompanied by a proportionate increase in cylinder capacity and a more than proportionate increase in boiler capacity. An evaporation of only 11.88 lbs. of steam at 200 lbs. pressure per sq. ft. of heating surface per hour will be required to develop the maximum theoretical horse power capacity of the Pacific, while in the case of the Atlantic type the boiler has to evaporate 13.6 lbs. of steam at 210 lbs. pressure per sq. ft. of heating surface per hour.

An extensive duplication of parts between the two classes of locomotives has been secured by care in working out the designs. The two boilers are practically identical in design, the

Ratios.

Weight on drivers ÷ tractive effort	4.50	4.23
Total weight ÷ tractive effort	7.09	5.31
Tractive effort x diam. drivers ÷ heating surface*	594.00	680.00
Total heating surface ÷ grate area	64.20	64.20
Firebox heating surface ÷ total heating surface, per cent.	6.60	6.60
Weight on drivers ÷ heating surface*	34.30	45.40
Total weight ÷ heating surface*	54.20	57.20
Volume both cylinders, cu. ft.	14.15	19.20
Heating surface* ÷ vol. cylinders	338.00	250.00
Grate area ÷ vol. cylinders	4.00	2.96

Valves.

Kind	Piston	Piston
Greatest travel	6 in.	6 in.
Outside lap	1 1/16 in.	1 in.
Inside clearance	⅛ in.	0 in.
Lead	¼ in.	3/16 in.

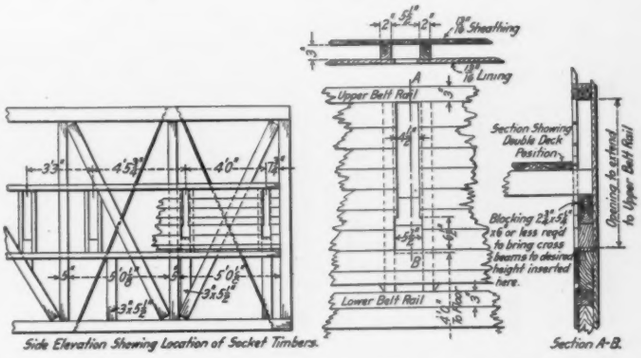
Cylinders.		
Kind	Simple	Simple
Diameter and stroke	24½ x 26 in.	26½ x 30 in.
Wheels.		
Driving, diameter over tires	73 in.	63 in.
Driving, thickness of tires	3½ in.	3½ in.
Driving journals, main, diameter and length	11 x 12 in.	11 x 12 in.
Driving journals, others, diam. and length	10 x 12 in.	10 x 12 in.
Engine truck wheels, diameter	33½ in.	33½ in.
Engine truck journals	6 x 12 in.	6 x 12 in.
Trailing truck wheels, diameter	43 in.	43 in.
Trailing truck journals	8 x 14 in.	8 x 14 in.
Boiler.		
Style	Ex. W. T.	Ex. W. T.
Working pressure	200 lbs.	180 lbs.
Outside diameter of first ring	74 in.	74 in.
Firebox, length and width	108 x 75¼ in.	108 x 75¼ in.
Firebox plates, thickness	⅜ and 5/16 in.	⅜ and 5/16 in.
Firebox, water space	4½ in.	4½ in.
Tubes, number and outside diameter	240—2 in.	240—2 in.
Flues, number and diameter	32—5⅜ in.	32—5⅜ in.
Tubes, thickness	No. 11 B. W. G.	No. 11 B. W. G.
Flues, thickness	No. 9 B. W. G.	No. 9 B. W. G.
Tubes, length	20 ft.	20 ft.
Heating surface, tubes and flues	3,395 sq. ft.	3,395 sq. ft.
Heating surface, firebox	240 sq. ft.	240 sq. ft.
Heating surface, total	3,635 sq. ft.	3,635 sq. ft.
Superheater heating surface	757 sq. ft.	757 sq. ft.
Grate area	56.5 sq. ft.	56.5 sq. ft.
Smokestack, diameter	18 in.	18 in.
Smokestack, height above rail	14 ft. 10 in.	14 ft. 7¼ in.
Tender.		
Tank	Water bottom	Water bottom
Wheels, diameter	33 in.	33 in.
Journals, diameter and length	6 x 11 in.	6 x 11 in.
Water capacity	9,000 gals.	9,000 gals.
Coal capacity	14 tons	14 tons

*Equivalent heating surface equals total heating surface plus 1.5 times superheater surface.

AUTOMOBILE CAR

The automobile business in the Northwest has grown to such an extent that the Chicago, Milwaukee & St. Paul finds it necessary to build large numbers of special box cars for this trade. It is now constructing 470 fifty-foot automobile cars at the Milwaukee shops, with underframes and trucks designed for a car capacity of 80,000 lbs. The general plan and some of the principal details are here illustrated. In addition to the unusual length the car is very high, measuring 10 ft. 6¾ in. from the floor to the carline, thus providing a capacity of 4,675 cu. ft. The Bettendorf steel underframe is used, and is 50 ft. 10 in. long by 9 ft. 7⅝ in. wide. The center sills consist of two 24-in. I-beams, tapered at the ends near the body bolster with separate draft sills beyond the bolster. The side sills are 6-in. Z-bars, with 3 in. x 6 in. nailing strips. The load is carried principally by the center sills, cross bearers made of 7-in. 15-lb. I-beams connecting the side and center sills. The end sills are 10-in. channels. The Miner friction draft gear and the Major couplers are set well up near the floor line, the top of the floor being only 3 ft. 7¼ in. from the top of the rail. This makes the height from the rail to the running board 14 ft. 10 in., and to the brake staff 15 ft. 4½ in. The side posts and braces are made of oak, 3 in. thick x 5 in. wide; the posts are reinforced on one side by 2½ in. x 2½ in. angles. The center posts at the ends are 4 in., 7½-lb. I-beams with 3 in. x 4 in. white oak pieces bolted to each side. The corner posts are double, and at one end are faced on the outside by 7 in., 9.75-lb., channels, to which the heavy hinges for the end doors are riveted. The end plate is faced with a 7 in. x ½ in. iron plate.

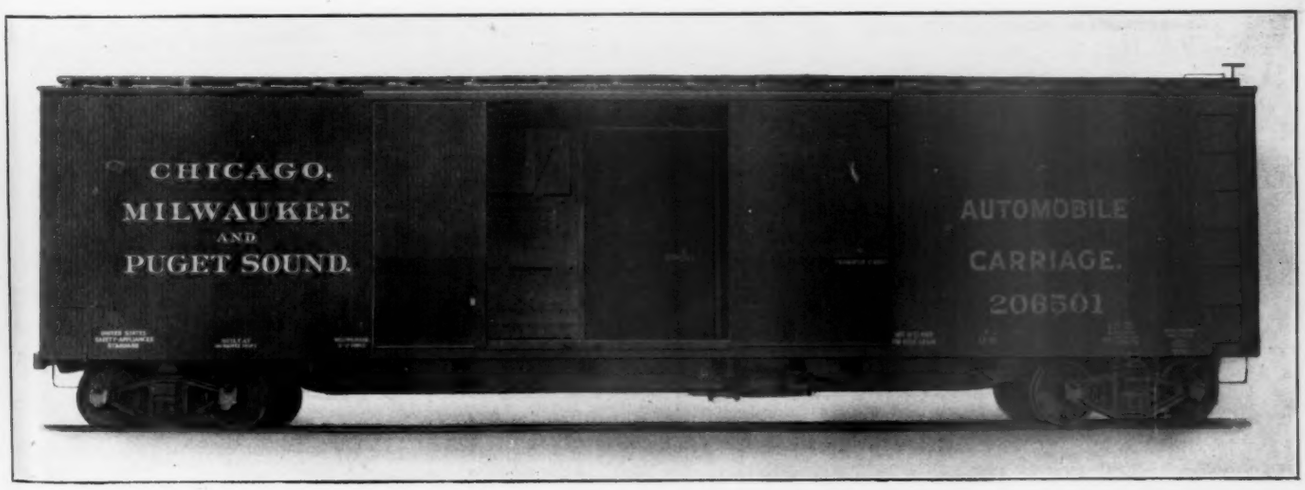
The special provisions for loading automobiles include doors


Sheathing
To Lining
Upper Belt Rail
Section Showing Double Deck Position
Opening to extend to Upper Belt Rail
Blocking 2"x5½" x6' or less reqd to bring cross beams to desired height inserted here.
Lower Belt Rail
Side Elevation Showing Location of Socket Timbers.
Section A-B.

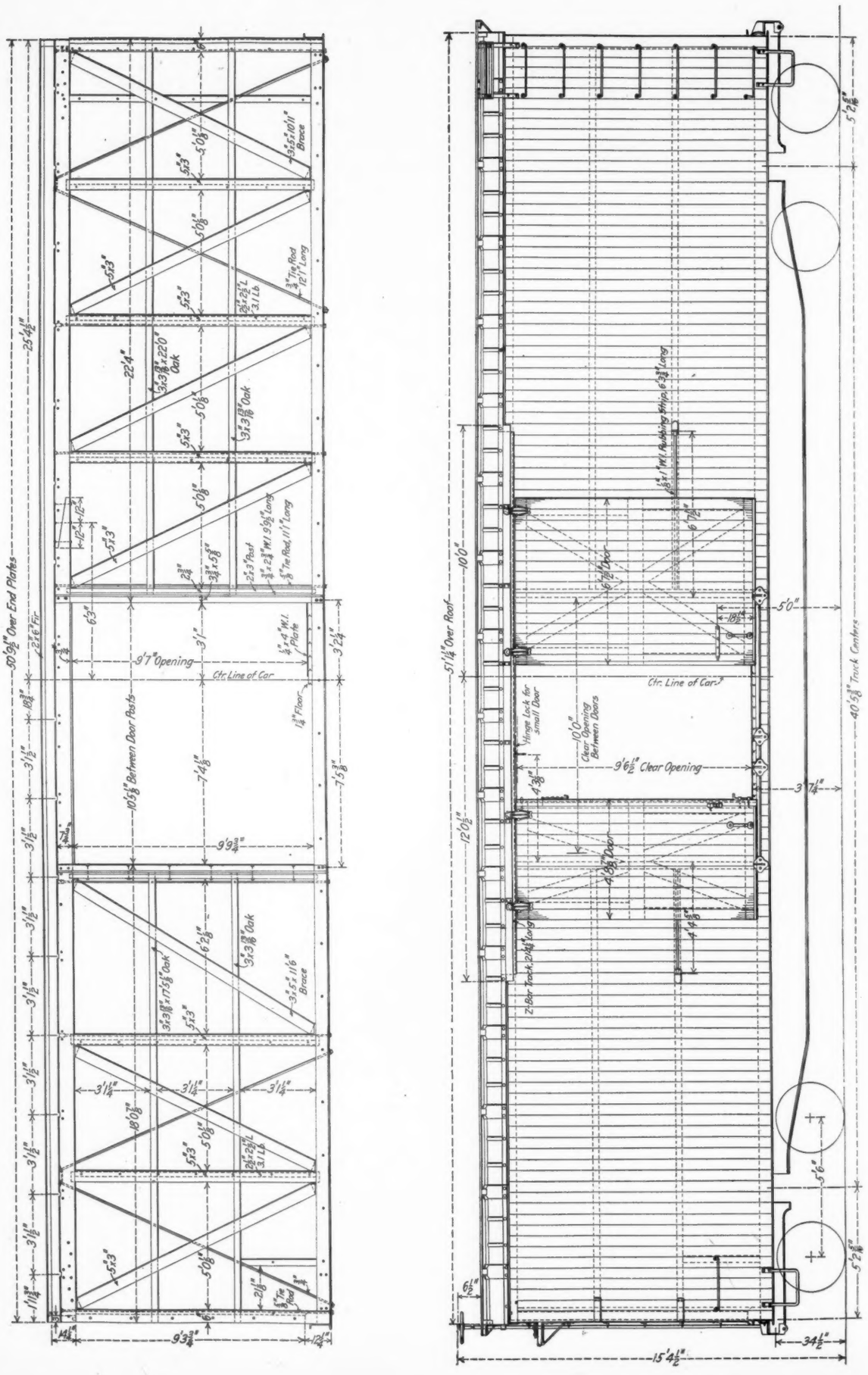
Arrangement of Double Deck Supports for Automobile Car.

at one end of which allow the full width of the car to be opened, wide doors at each side, and an adjustable double deck. These features have been worked out in an original manner, and are clearly shown in the detail drawings. Each end door is fitted with three large malleable iron strap hinges, with each butt secured to the channel post with 8 rivets. The doors are secured by a 1¾ in. x 6 in. bull bar, which swings on a pivot bolt fixed in one of the doors, the ends of the bar entering notches in the corner posts.

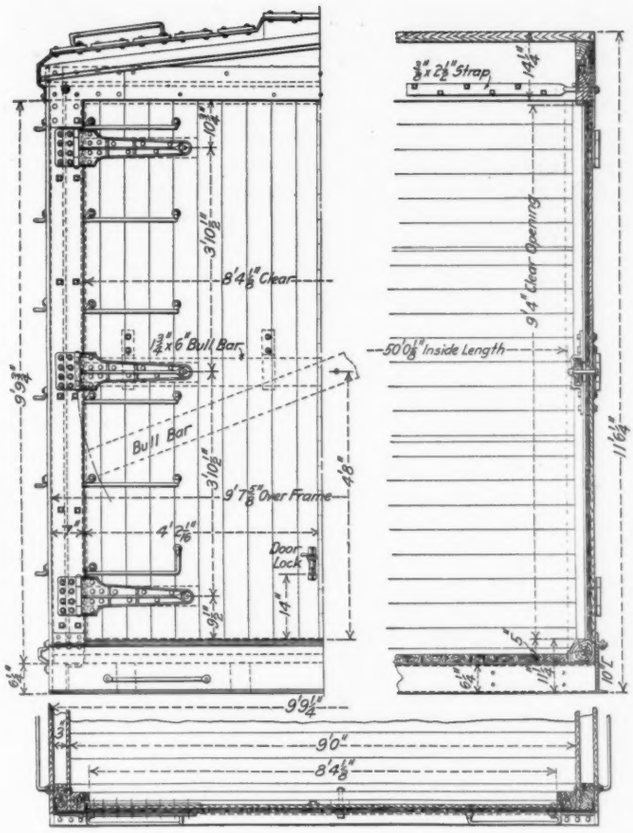
There are two doors on each side which provide a clear opening of 10 ft. when both are opened. One of them is 4 ft. 8⅞ in. wide, and the other is 6 ft. 7½ in. wide. The wider door covers the central opening as in ordinary box cars, and the narrow door is to the left in each case so that their centers are on a diagonal line with respect to the floor plan. The intermediate door post is made of oak, 3 in. thick x 4⅞ in. wide, and is arranged to be made fast with the narrow door when the wide opening is not needed. The car is then equivalent to one with central side door openings 6 ft. wide on each side. This feature of securing the narrow doors with a substantial post



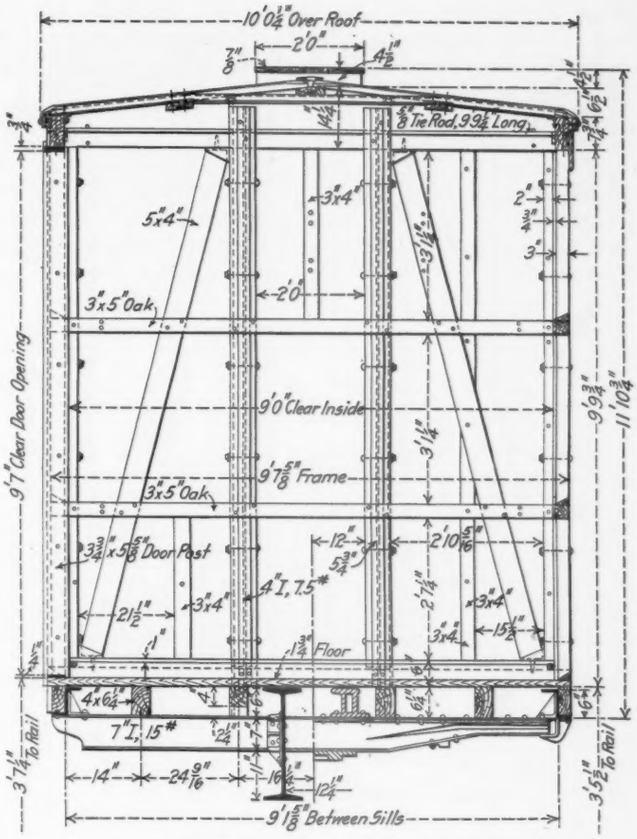
Automobile-Carriage Car; Chicago, Milwaukee & Puget Sound.



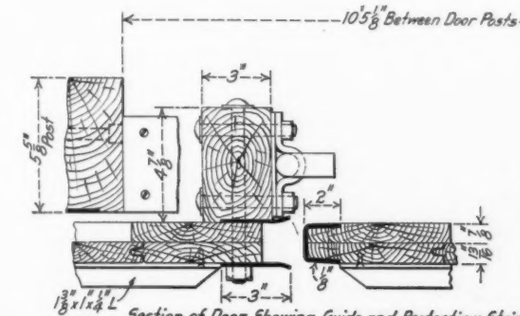
Elevations of 50-ft. Automobile Car for the Chicago, Milwaukee & St. Paul.



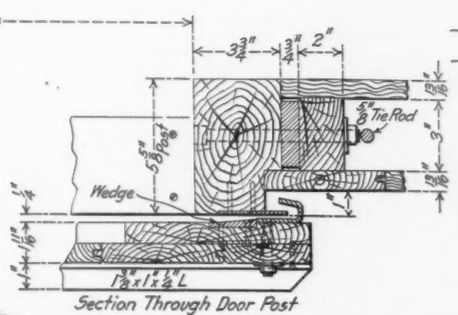
Construction of End Door on Automobile Car.



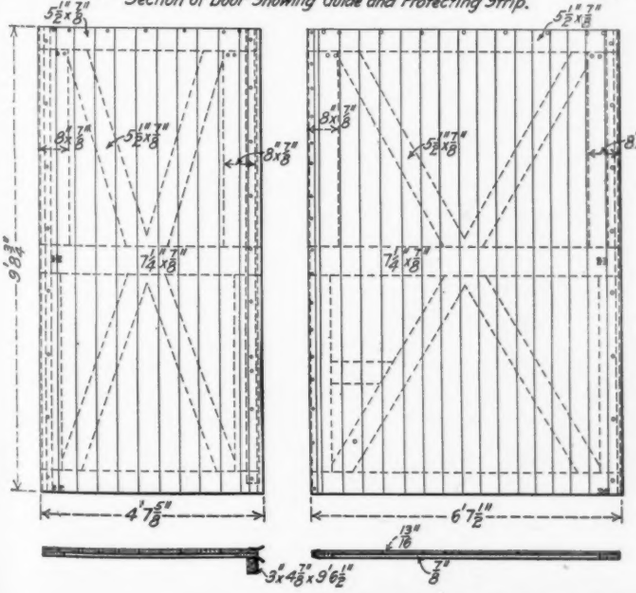
Cross-Section of Automobile Car.

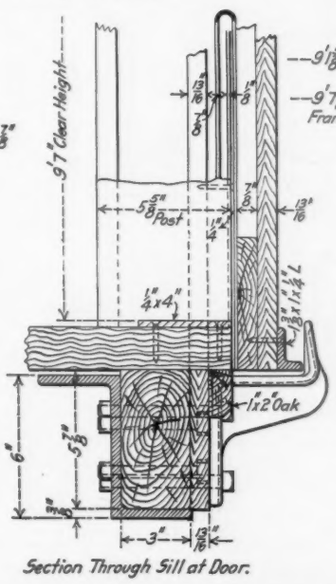


Section of Door Showing Guide and Protecting Strip.

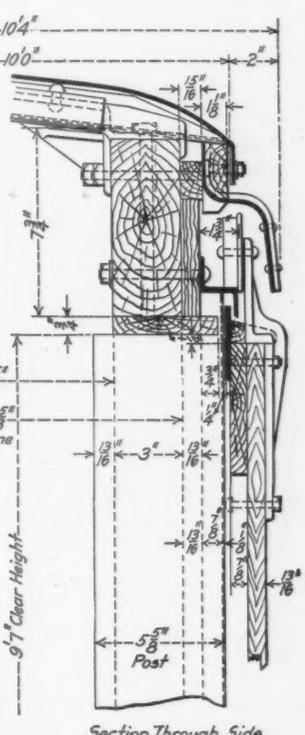


Section Through Door Post





Section Through Sill at Door.



Section Through Side Plate and Door.

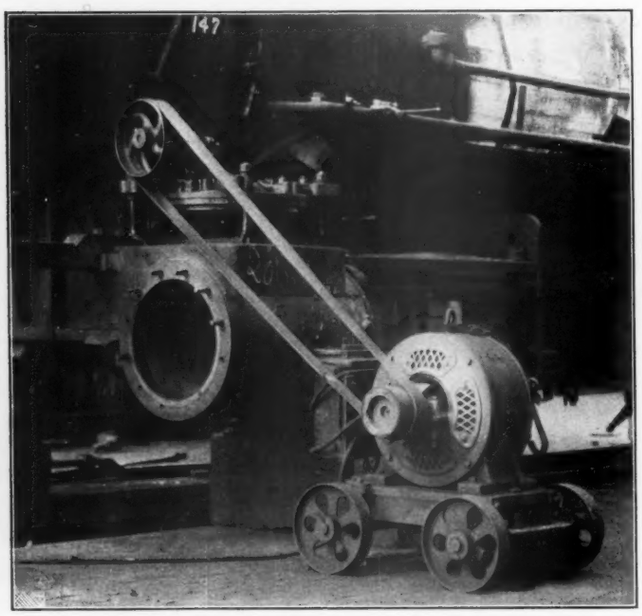
Side Doors of Automobile Car and Details of Their Construction.

fitted between the floor and side plate is patented. The detail drawing shows the narrow door bolted to the intermediate post; the edge of the door is fitted with ⅛ in. protecting strips into which the edge of the wide door fits.

Provision is made for the installation of a temporary double deck, as shown in one of the illustrations, in order to load the car more nearly to its capacity and to the best advantage. The inside lining is nailed to furring strips which are specially arranged for the insertion of blocking to support the cross bearers for the temporary deck. The height of the deck may be regulated by the number of blocks which are placed in these pockets. The belt rail is supported by special posts directly below the blocking. The cars are fitted with the Bettendorf boltless trucks, the weight with these trucks being 46,800 lbs. Other fixtures include the Westinghouse air brakes, Hutchins' metallic roof and Security side door fixtures.

PORTABLE ELECTRIC MOTOR

In many shops, tools and devices operated by compressed air have become so numerous that it is practically impossible for the compressors to maintain the standard pressure, with the result that not only are the compressors themselves being operated very uneconomically, but the efficiency of the air riveting and chipping hammers and other air tools throughout the shop is greatly reduced. Most shops are provided with electric current, and there are many cases where electric power can be used in place of compressed air with equal ease, greater convenience and greater economy. If this transformation is made in a sufficient number of cases the efficiency of the compressors and other air tools will be greatly increased and the net result will be a decided saving.



Portable Motor Belted to Valve Facing Machine.

As an illustration of one of the points wherein an electric motor can be used equally well, or better than an air motor, the accompanying photograph shows a valve seat facing machine in operation in the Macon shops of the Central of Georgia. The motor shown is of the direct current variable speed type, mounted on a small truck which also carries the controller. This motor is wheeled around the shop and is used for driving either the valve seat facing machine or the cylinder boring machine. This practice is also being followed in some other shops and has given good satisfaction.

OXY-ACETYLENE CUTTING AND WELDING*

BY J. A. WARFEL.

The highest temperature of the best solid fuel furnace is about 3,000 deg. Fahr. The oxy-hydrogen, which was the hottest of gas flames, is something less than 4,000 deg. Fahr. The oxy-acetylene flame gives a temperature of about 6,300 deg. Fahr., being more than double the hottest solid fuel heat known. Within the last few years a really satisfactory method has been developed for welding and cutting with the use of oxygen and acetylene gases by means of a blowpipe, simply because we are able to get a very high temperature, full control, and simple application, which are necessary for efficiency.

In order to relieve a welded piece of metal from internal strains due to welding, it is desirable not only to pre-heat the whole of the part when possible, but also to re-heat it after welding to a cherry red heat. This causes a molecular rearrangement to take place within the metal, which will bring about a distribution, if not an actual dispersion, of internal strains. In the case of cast iron this treatment is imperative where a repair is effected in a restrained member of the structure, and not only should pre-heating and re-heating (or annealing) be always employed, but the raising and lowering of the temperature in so doing should be slow, and the casting should be kept entirely free from air drafts, or other extraneous cooling effects. This treatment is less essential for steel, but it is always beneficial. Too much attention cannot be paid to this physical aspect of welding, and even when the process of fusion-welding is employed to fill up flaws in castings, it is desirable, when possible, to heat the whole structure before and after treatment.

The strength of the weld produced by the flame is almost invariably somewhat less than that of the original material. This may be due to the use of welding strips of inferior tensile strength or to those internal strains which have already been referred to. It is also undeniable that the structure of the material in the weld is less homogeneous than in other parts. This, however, is largely a matter of skill on the part of the individual welder. It is possible for a competent welder, at his discretion, to give a greater or less strength to the welded part.

Very often the question is raised as to whether or not iron and steel plate, when welded by the oxy-acetylene process, do not show a certain quantity of carbon formation in the weld, thereby rendering the material at the point of juncture somewhat brittle, thus having a deteriorating effect on the weld. To determine this point, one of our friends had a number of samples taken and plane sections were produced by cutting vertically through the weld. The samples were then ground and polished in the ordinary manner. One part was etched and treated in an alcoholic solution of pictric and showed, according to microscopic photographs taken, that the distribution of the ferrite and pearlite was perfectly regular and even throughout the entire welded portion.

When overheating or burning has caused the metal to crystallize through to both sides of the weld, the fibrous structure of the metal may be so far destroyed, and the strength of the weld so impaired, as to make the weld worthless, and even annealing may fail to return the metal to its original condition.

Oxy-acetylene welding is a good thing, and to be made successful must be regarded as a trade, which can only be mastered by intelligent work and gradual development from simple to difficult jobs (and truly cannot be mastered within a few days, as we were sometimes led to believe by some over-zealous salesmen). Much depends on the intelligence and ability of the

*Abstract of a paper and discussion at the meeting of the Railway Club of Pittsburgh, Pa., January 26, 1912. Mr. Warfel is manager of the Pittsburgh, Pa., office of the Linde Air Products Company.

workman. A skilled welder will use a hammer freely as well as a blowpipe, more especially on a vertical or overhead weld in plates which are subsequently to be subjected to pressure strains. By the judicious use of hammering on the welded part at the right moment, the metal can always be made denser, with the result that the strength of the weld is increased.

The following suggestions are practical and necessary for success in welding:

Great care must be taken to remove scale and entirely clean the surface and edge of the metal where the welding is to be done. You must be careful to prepare the parts to be welded either by beveling deeply so as to enable the metal to be melted throughout the entire thickness of the plate or by cutting away sufficient metal to enable the blowpipe flame to penetrate to the under side of the plate, and thus insure that the added metal is welded-in throughout.

In the thicker sections of the plate the edges should be melted inwards for at least 25 per cent. of the thickness of the plate, while adding additional molten metal from the feeding wire. This is a secret of good welding which beginners invariably neglect.

When working on sections of material, the experienced welder displays his skill by raising the flame just at the moment when fusion has proceeded so far that complete welding is assured, and before the heat has advanced to a point where the material may be destroyed or pierced. Practice enables him to conduct this operation with great rapidity. It is especially important in thin work that the flame of the blowpipe should not be oxidizing, but rather decidedly reducing.

Light hammering in the case of wrought iron and steel is, when possible, always desirable while the metal is in a plastic condition. Never attempt to re-weld a cracked weld. Always cut or drill out a larger area than before, in order to remove all filling-in material; then re-weld, and insert a patch if required. Never neglect to pre-heat and afterwards anneal as much as possible. The importance of this treatment cannot be exaggerated, not only in dealing with cast iron, but in materials of all kinds. In the welding of ordinary iron, or mild steel plates, it is found that the best general results are obtained by employing as the welder feeder, soft Norway or Swedish iron wire, as free as possible from carbon.

In the welding of cast iron, rods of ferro-silicon are employed as feeders. Pure metallic copper is also sometimes employed as a feeder in the repair of complicated cracks in cast iron, with which it is found to make a satisfactory weld. As a general rule, it is also found advantageous to employ some welding flux, of which there are several varieties on the market. Copper to copper fusion welding is frequently employed, but chiefly on light work. Owing to the great heat conductivity of copper, local welding cannot be effected with the same economy as in the case of iron or steel. Aluminum is very successfully welded today by simply keeping out of the weld the film of aluminum oxide, which forms in the weld. It has been interesting to watch the rapid development of oxy-acetylene welding during the past two years, and the next two years will, without doubt, see a much more rapid development.

The paper was illustrated by lantern slides, showing methods of cutting and welding firebox side sheets and making other repairs to locomotive boilers. One illustration showed six cracks between staybolts on the inside sheet at the fire line. The time for doing the work included eight hours for the welder and three hours for the boiler maker, the total cost of labor and material being $8.68. If these cracks had been plugged the cost would have been about $18. Another example was that of a patch 32 in. x 60 in. welded in the side sheet of the firebox, where the time required was 17 hours for the welder and helper, at a total cost for labor and material of $20.50. A crack 8 in. long on the inside of the smokebox was welded in 3½ hours at a total cost of $4.

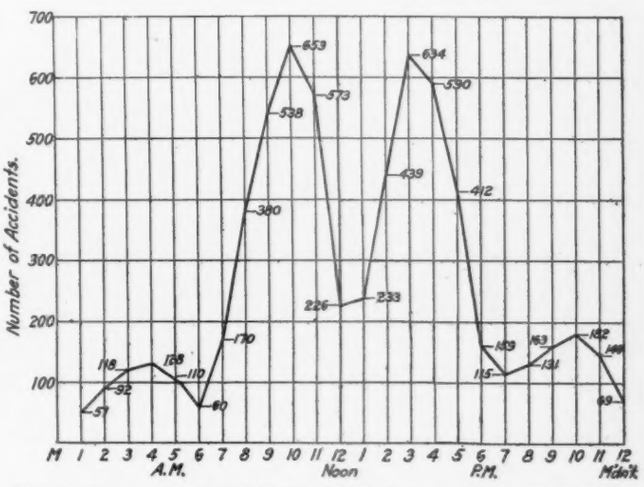
DISCUSSION.

In reply to a question in regard to pre-heating, Mr. Warfel said it was not necessary to pre-heat on side sheets, but it is a good plan to re-heat around the weld a short distance, after finishing the weld. L. A. Way explained the utility of the oxy-acetylene flame for cutting off heads of steel castings, and said, "We had in our foundry four high speed inserted teeth saws, and it took two men on day turn and two men on night turn to keep up with our work with these four saws. With the acetylene flame cutter one man working nine hours a day is able to keep up with the work. The flame will cut off a steel casting while a man is setting it up and getting it ready for the cold saw." Mr. Warfel explained that the proportion of oxygen should be 1½ cu. ft. to one cubic foot of acetylene. If too much oxygen is used it will oxidize the weld. Welding tubes into the back tube sheet of locomotives has been tried by two railway companies without success, and at the present time one of these companies is experimenting with the brazing of tubes. It is claimed that they do this successfully in France.

HOURLY FLUCTUATION OF ACCIDENTS*

The recent investigation reported in the Twelfth Biennial Report of the Bureau of Labor of the State of Minnesota shows that for the twenty-four hours there are four periods during the day at which the greatest number of accidents occurred. This is clearly shown on the accompanying diagram. The night hours, having much the fewer men at work, have by far the fewer accidents. There are, doubtless, more men at work in the early part of the night from seven to midnight than in the latter part from midnight to six. There seemed to be a highest point at the middle of the four periods, viz.: at 4 a. m., 10 a. m., 3 p. m. and 10 p. m.

The largest number of accidents are to be expected when the



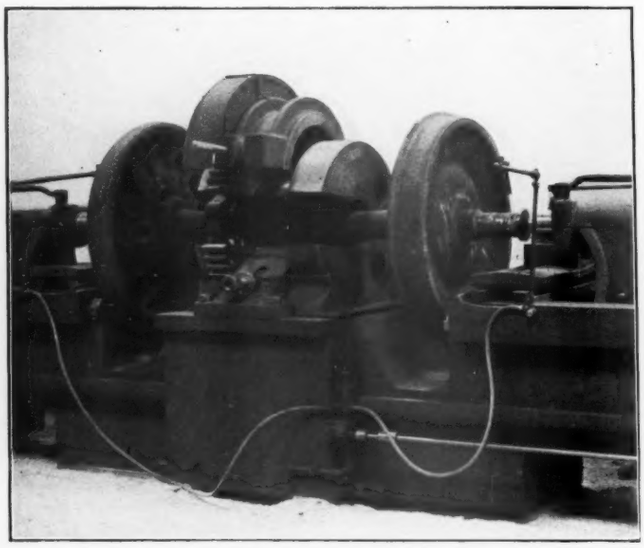
Hourly Curve of Industrial Accidents in the State of Minnesota During 1910.

first freshness which results from a rest from labor has been worn off and when the workers are doubtless at their highest speed of effectiveness and greatest nervous tension. The next highest number belong to a period a little later, when both physical and nervous powers have been let down by the fatigue of the day's work. Fatigue is doubtless responsible for a lowering of attention and probably a willingness to have the attention distracted from the work in hand. For illumination to secure effectiveness in the work areas, the factory of safety is rather a by-product. That is, illumination planned to stimulate and favor rapid production will be a little greater than that necessary for safety alone.

*Reported in the Journal of Industrial Safety.

JOURNAL TURNING LATHE

It is often necessary to refinish the journals on car axles when the wheels are not to be removed from the axles. With the more general introduction of the steel wheel in freight service this operation is becoming continually more frequent. A machine suitable for this purpose must of necessity be constructed



Journal Turning Lathe; Can Also be Used for Turning Axles.

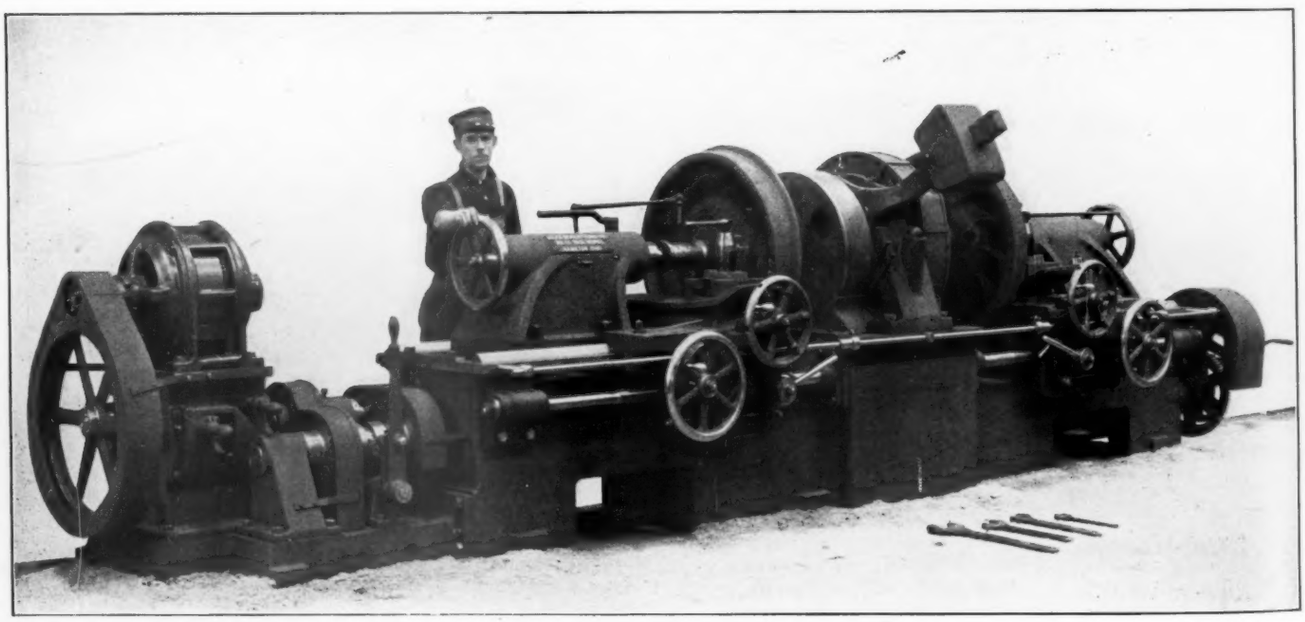
to turn out accurate work since the cuts taken will be very light and perfect roundness is desirable. If the wheels are carried on the centers only, as is generally necessary where an old machine is adapted for this purpose, there is bound to be more or less springing of the axle and lost motion at the centers which will be reflected in the quality of the work. Of course while some of the older designs of car wheel lathes were arranged and fairly well suited for journal turning, these machines are generally pretty well crowded with the work for which they are best adapted, and in fact the more modern tools of high capacity are not even arranged to permit journal turning.

Recognizing that a demand already exists which will become more insistant, the Niles-Bement-Pond Company has designed a machine especially for this purpose. It is arranged for center drive with a gap in the center head for putting in and taking out the axles, and is provided with suitable speeds and feeds for rapid, accurate turning and rolling of the journals. It has a capacity for axles carrying wheels up to 42 in. diameter on the tread. Both journals can be finished at the same time.

While journal turning will not require much power, the machine is designed throughout and is well suited for axle turning if a somewhat larger motor is provided. Arranged for both kinds of work, this machine could probably be kept busy in practically any shop where it would not be advisable to install it for journals alone.

In the arrangement of the driving mechanism, this machine is quite similar to a car wheel lathe, with the exception that the gap in the driving gear is not filled. There are two driving pinions provided, so arranged that when one is opposite the gap the other is in mesh and performs the work alone. The top bearing at the center is hinged at the front of the machine and provided with a counter weight. It is opened by simply loosening one nut on the clamping bolt, which is then swung out and frees the bearing, permitting the pair of wheels to be quickly handled. The driving dog is carried on an automatic adjustable driver plate, and is so constructed that it can be quickly applied and has a very powerful grip. The arrangement is such that there is no springing of the axle under the strain of the cut. The feed gears are supplied with a quick change arrangement using a sliding key and give all the necessary feeds for turning and burnishing.

The machine shown in the illustration is fitted with an alternating current, constant speed motor which makes necessary the group of gears shown between the motor and the bed of the machine. Where a variable speed, direct current motor can be used, this gearing will not be required. A 10 h. p. motor is suitable for journal work only, but if the machine is also to be used for axle turning, a 25 h. p. motor should be used.



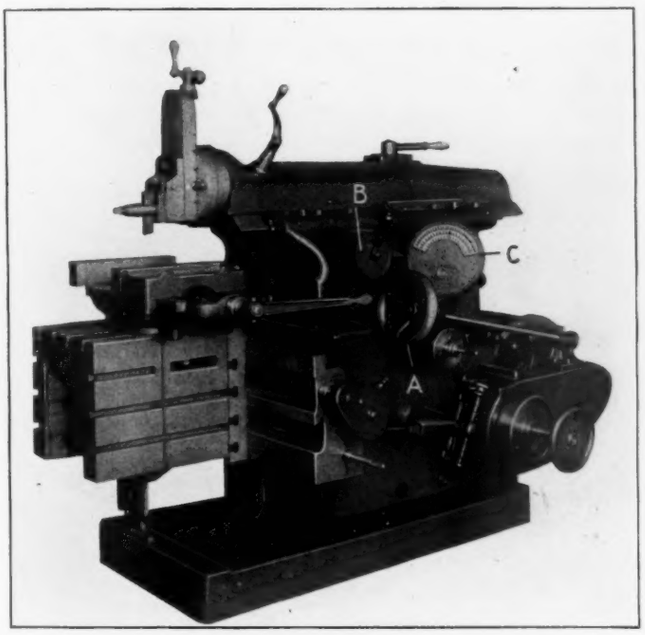
Motor Driven Journal Turning Lathe.

Railway Accidents.—Out of 715 personal injuries on the Wheeling & Lake Erie during the year ending December 1, 1911, 414, or 58 per cent. were sustained in the car and locomotive shops and in engine houses.

AUTOMATIC CONTROLLER FOR ELECTRIC MOTOR

Convenience of control forms one of the principal characteristics of all modern machine tools and in the case of those which are driven by individual motors, the operation of the motor controller is in many cases more frequently necessary than is the use of adjusting levers, etc., forming part of the machine. The controller should therefore be within easy reach of the operator, simple in its operation and so located as to be safe from accidental change.

A controller which fulfills these conditions and possesses advantages of considerable importance for certain classes of machine tools is shown as applied to a Gould & Eberhardt motor driven shaper in the accompanying illustration. In this case the shaper is equipped with a 5 h. p. Reliance adjustable speed motor of the armature shifting type, giving a speed range of



Shaper Fitted with an Automatic Controller.

300 to 1,500 r. p. m., which is controlled by the operation of the hand wheel *A* in the illustration. It is also equipped with Reliance speed dial *C*, which was fully illustrated and described in the March issue of the *American Engineer*.

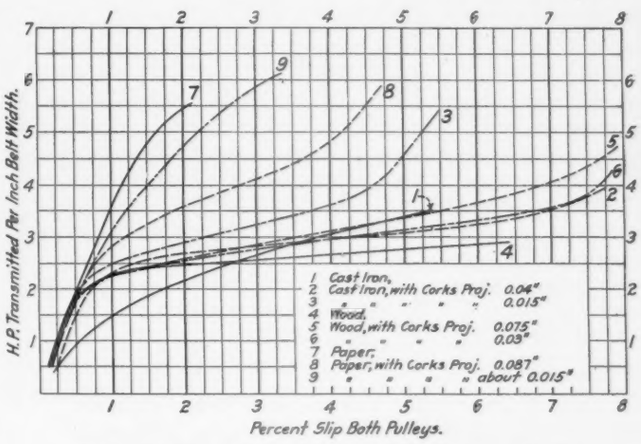
A small drum switch *B* controls the starting and stopping of the motor, and also has a third point which puts into action a dynamic brake, making a brake clutch unnecessary on this machine. In addition to the operator's switch on the machine the controlling apparatus includes an accelerating unit which automatically accelerates or decelerates the motor, through the action of three, series wound, solenoid operated, switches which also act as current limit relays. This apparatus together with the line switch and fuses is mounted on a panel which can be secured to a post or frame near the machine.

When the operator's switch is thrown to a running position marked "Start," the current flows through the motor and all of the starting resistance in the accelerating switches, as well as through the solenoid of the first switch which is then connected in series. As the motor accelerates, the current drops, and when it reaches a pre-determined value, the first switch closes, automatically cutting out one-third of the resistance and throwing the solenoid of the second switch in series. When the current drops still further this switch goes out of action, cutting out still more resistance and putting the third solenoid in the circuit. This in turn closes and the motor is directly on the line without resistance. When the switch is thrown to the "off" position the circuit is simply opened and the motor gradually comes to a stop after it has absorbed its stored rotative energy. If, however, the switch is thrown to the "brake" position, all of the resistance in the accelerating unit is put in series with the armature and quickly and smoothly brings the motor to rest, the accelerators acting as decelerating switches and cutting out the resistance step by step as the current generated by the motor decreases, due to its slowing down.

This controller is designed and manufactured by the Electric Controller & Manufacturing Company, Cleveland, Ohio, and while the one illustrated does not have the reverse position, other designs of the same general type are provided with apparatus for this purpose.

DRIVING EFFICIENCY OF PULLEYS

In a paper prepared by Prof. Sawdon* and presented before the National Association of Cotton Manufacturers, there is discussed at some length results obtained from an elaborate series of tests made by the author on the transmitting capacities of different pulleys in leather belt drives. The accompanying diagram and


H.P. Transmitted Per Inch Belt Width.
Percent Slip Both Pulleys.
1 Cast Iron.
2 Cast Iron, with Corks Proj. 0.04"
3 " " " " 0.015"
4 Wood.
5 Wood, with Corks Proj. 0.075"
6 " " " " 0.03"
7 Paper.
8 Paper, with Corks Proj. 0.087"
9 " " " " about 0.015"

Relative Transmitting Capacity of Different Pulleys.

tables show the general results obtained from pulleys of three different materials, each with and without cork inserts of different sizes. These figures were obtained at a belt speed of 2,200 ft. per minute and an initial tension of 170 lbs. per square inch of belt cross section. The belt was single ply, oak tanned leather, 5 in. in width. The pulleys were 24 in. in diameter, with 8-in. faces and without crowns. The tables give the horse

TABLE 1.

HORSE POWER TRANSMITTED BY VARIOUS PULLEYS PER 1 IN. BELT WIDTH—FROM TESTS.

No.	Kind of pulley.	Slip.* 1 per ct.	1½ per ct.	2 per ct.	Comparative transmitting capacity at 2 per cent. slip.
1.	Cast iron	1.48	1.86	2.16	100.0
2.	Cast iron, with corks projecting .04 in.	2.32	2.57	2.69	124.5
3.	Cast iron, with corks projecting .015 in.	2.50	2.72	2.89	133.8
4.	Wood	2.29	2.43	2.47	114.3
5.	Wood, with corks projecting .075 in.	2.24	2.46	2.60	120.4
6.	Wood, with corks projecting .03 in.	2.25	2.43	2.55	118.0
7.	Paper	3.56	4.77	5.46	252.8
8.	Paper, with corks projecting .087 in.	2.85	3.26	3.57	165.3
9.	Paper, with corks projecting (about) .015 in.	3.12	4.00	4.72	218.5

*Cornell University, Ithaca, N. Y.

power transmitted for different percentages of slip. The speed of the belt and its tension were kept constant, but the horse powers transmitted were varied, and the corresponding percentages of slip were recorded by the slip-meter.

Table 1 shows the horse power transmitted by the various pulleys per inch of belt width as obtained from the tests. The author states, however, that this table did not take into consideration the variations in the arc of contact, nor the greater stress occasioned on the tight side of the belt by the pulleys carrying the higher loads, which of course would reduce the life of the belt. He therefore prepared Table 2, which gives the relative transmitting capacities of the different pulleys when based on constant arcs of contact and constant belt tensions. These values do not represent actual observations from the tests, but were calculated by means of Nagle's formula using an arc of contact of 180 deg., and a maximum belt tension of 250 lbs. per sq. in. of cross section.

TABLE 2.

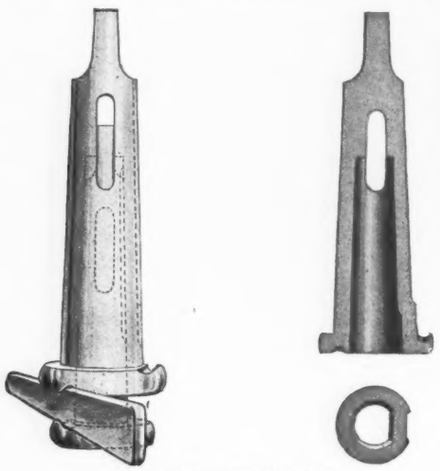
Calculated Horse Power Transmitting Capacity of Various Pulleys per 1 In. of Belt Width.

No.	Kind of pulley.	Slip. 1 per ct.	1½ per ct.	2 per ct.	Comparative transmitting capacity at 2 per cent. slip.
1.	Cast iron	1.72	2.03	2.33	100.0
2.	Cast iron, with corks projecting .04 in.	2.31	2.43	2.49	107.0
3.	Cast iron, with corks projecting .015 in.	2.41	2.52	2.61	112.1
4.	Wood	2.36	2.41	2.46	105.6
5.	Wood, with corks projecting .075 in.	2.26	2.37	2.44	104.8
6.	Wood, with corks projecting .03 in.	2.26	2.40	2.44	104.8
7.	Paper	2.78	3.08	3.20	137.5
8.	Paper, with corks projecting .087 in.	2.58	2.75	2.84	122.0
9.	Paper, with corks projecting (about) .015 in.	2.60	2.95	3.10	133.2

*Increased distance traveled by the belt as compared to the face of the pulley expressed as a percentage. The creep is also included in these figures.

NEW TYPE OF DRILL SOCKET

A drill socket, differing in several particulars from any now on the market, is shown in the accompanying illustration. It is provided with a lip around the bottom with grooved extensions so arranged as to permit the insertion of a key for readily separating nested sockets. It also forms a reinforcement at the base

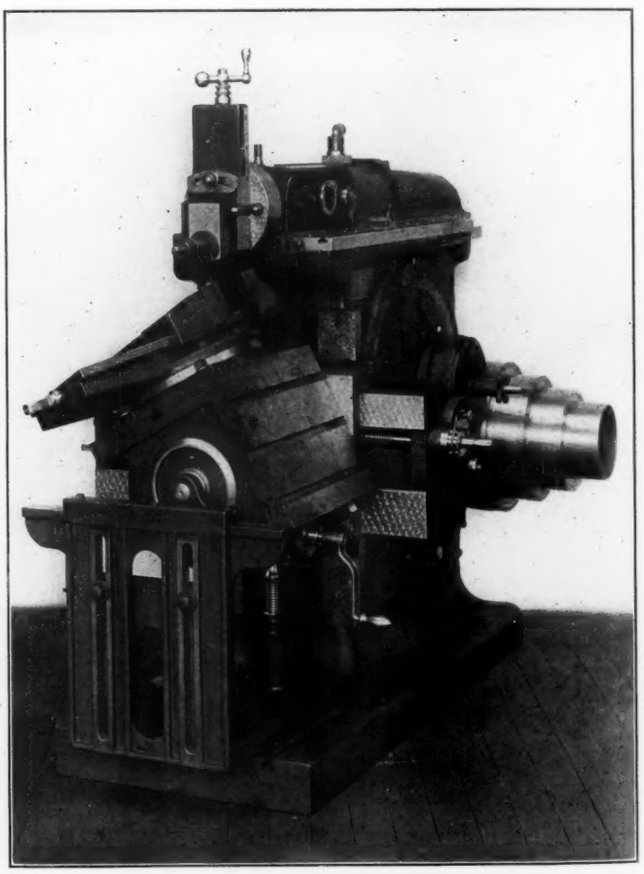


"Wear Ever" Drill Socket.

which greatly increases the strength and life of the socket. These sockets are made of special steel, heat treated, hardened and ground, and are in one piece. The socket has a flat key made integral with the socket on the inside and a similar keyway on the outside, both extending almost the entire length of the socket, thus giving a positive drive and permitting the use of drills on which the tangs have been twisted off, requiring only that a flat be ground to fit the internal key. These sockets are, of course, made to conform to the standard Morse taper and will nest inside any other type of socket, and will also fit the spindle of any drill press. The "Wear Ever" socket, as it is called, is made by Scully-Jones & Company, Chicago, Ill.

SHAPER KNEE SUPPORT

A support for a swiveling knee has been designed and is being applied to 16 in., 18 in., 20 in., and 24 in. shapers, built by the Stockbridge Machine Company of Worcester, Mass. This support is of the same general type previously used by this company in connection with the standard type of box knee, but is arranged to permit the revolving of the knee, which operation is controlled by a worm and gear operated by the handle shown in the illustration. A graduated dial reading in degrees is provided on the front in connection with the knee support and permits an accurate setting for planing at any angle. If one



Support for Swiveling Shaper Knee.

side of the knee should also be provided with a tilting top with graduations, the shaper will be suited for planing compound angles of any character.

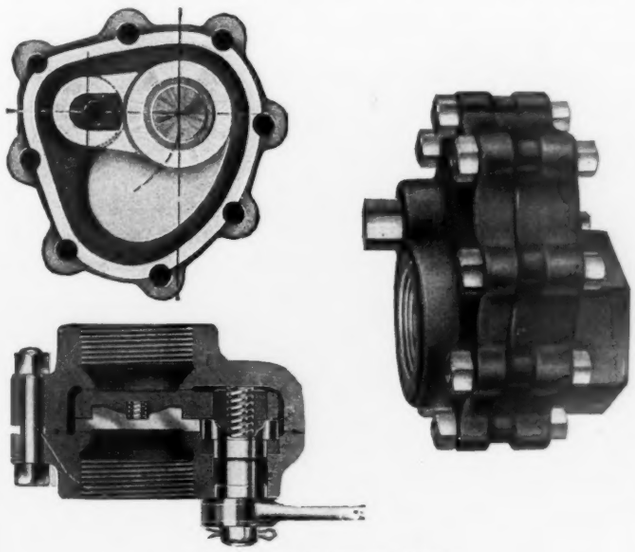
It is, of course, readily apparent that with the present practice of large shaper capacity, a knee support is practically indispensable, and while they are quite generally fitted on stationary knees, this is one of the first, if not the first, example where the same arrangement has been fitted with a swiveling type knee.

Reinforced Concrete Telegraph Poles.—The telegraph department of the New Zealand government is replacing wooden telegraph poles with reinforced concrete poles.

EVERLASTING BLOW-OFF VALVE

The Everlasting blow-off valve is designed for the severest conditions of blow-off service on locomotives, and differs from others now on the market in several important particulars. The boiler pressure is the only means used to keep it tight, and, as the valve disk never leaves the face of the valve, but is tightly pressed thereto, it is impossible for scale or sediment to get between them and thereby cause leakage, which is the common defect of blow-off valves. Another good point in this valve is the construction of the case, which is made in halves and bolted together. This is more expensive than the solid case used in most other valves, but the accessibility for repairs and inspection attained by this feature is a strong point of merit.

By unbolting the two bonnets the whole working mechanism of the valve can be taken out without the use of hand tools, and the faces may be re-surfaced in ten or fifteen minutes and made as good as new. The valve face is chilled and ground, and the disk is made of the very hardest nickel bronze, giving a remarkable wearing quality to these surfaces. This valve has no stuffing box, and it will be seen that the mechanism is arranged on very much closer centers than would be possible if the stuffing



Everlasting Blow-off Valve.

box were used. A much smoother pull is thus secured, and this materially reduces the effort required to open and close the valve.

The inlet orifice is made tapered and slightly smaller than the opening in the valve face; that is, it is "choke bored." As these openings are eccentric and very close together, the greater part of the solid matter which is carried out with the blow-off enters the discharge pipe without impinging upon the valve face at all. This relieves the face from much of the wear it would otherwise have. By this means also there is obtained a syphoning action which cleans the valve at each operation. The valve is simple, compact, very strong and very rarely requires repairs. A large experience with these valves shows that they are practically self-grinding, as the disk revolves when being operated. The instructions state that the valves should be operated frequently, at least once a day, as this tends to keep them in good condition and is beneficial in helping to clean the boiler.

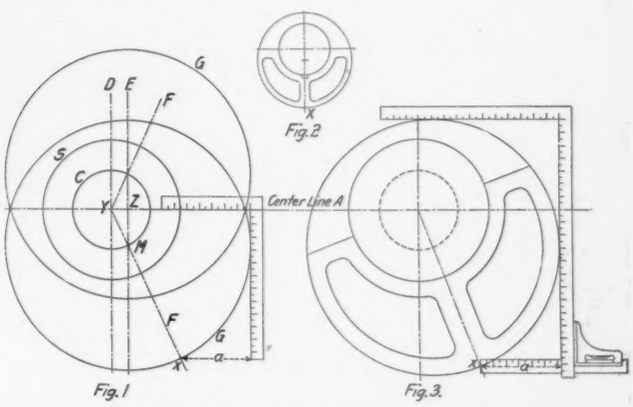
The 1½ in., 2 in., 2½ in. and 3 in. sizes will stand 150 lbs. hydrostatic pressure, and each valve is tested with 250 lbs. steam pressure before leaving the factory. The Central of Georgia has used the Everlasting valve as standard for three or four years. All engines on that line are equipped with four such valves, as the water in that region requires frequent blowing off. The same valve is used throughout the engine house at Macon, Ga., in connection with the hot water washing system, and is found very satisfactory for this purpose. It has been used for some time with good results by the Chesapeake & Ohio, and all the new locomotives of the Chicago & North Western are equipped with it. The valve is made by the Scully Steel & Iron Company, Chicago.

LAYING OUT KEYWAYS FOR ECCENTRICS

BY CHARLES MARKEL.

On locomotives fitted with the Stephenson valve gear the work of chipping the keyway in the axle after the valve is set has always been one of so great difficulty and inconvenience that it has stimulated the inventive faculties of many foremen and machinists, resulting in a number of methods, tools and machines to perform the operation in the shortest time and with the least labor. On the Chicago & North Western at the Clinton, Iowa, shops a method is in use which permits the laying off of the keyway on the axle before the wheels are under the engine. The eccentrics can be accurately fitted and secured before the locomotive is wheeled, and if the work is carefully done there will be no need for changing them when the valves are run over.

A face plate or a large piece of tin or sheet iron is used by the valve setter on which he draws the straight line *A*, which represents the line connecting the center of the axle and the center of the link block when the rocker arm is in a vertical position. On this horizontal line *A* a vertical line *D* is erected. From the intersection of these two lines, which is to represent the center of the axle, the circle *S* is described with



Laying Out Keyways for Eccentrics.

a radius equal to half the diameter of the axle at the point where the eccentric is to be placed. The circle *C* is then drawn with a radius equal to the throw of the eccentric. From the center point *Y* on the line *A*, the distance *YZ*, equal to the lap plus the lead (lead is subtracted if negative), is then laid off. This is of course only done in cases where the rocker arms are of equal length. If they are of different lengths this distance is proportioned to suit. From point *Z* the perpendicular line *E* is drawn. From the point *Y* line *F* is drawn passing through the intersection of the line *E* with the circle *C* (point *M*). With *M* as a center and a radius equal to that of the eccentric, circle *G* representing the outside of the eccentric is described. A 2 ft. square is then laid with its shorter end on the center line *A* and the other leg tangent to the circle *G*. The distance from the point *X* where the line *F* intersects circle *G* to the inner edge of the square is measured. Call this distance *a*.

The eccentric itself is next laid out, using a piece of wood inserted in the axle fit with pieces of tin on which to accurately lay out the centers of the axle and the eccentric. When this is done a line is carefully drawn through them and the point where this line intersects the circumference is prick-punched, this be-

ing point *X*. The eccentric is then placed on the axle and a combination square with a spirit level is set with its rule projecting a distance equal to the distance *a* plus the width of the plate of the carpenter's square which is to be used. A carpenter's square is then set over the eccentric and the combination square is adjusted to it, as is shown in Fig. 3. The wheels and axle are then so located that the crank pin is plumb and the eccentric is moved on the axle until the point *X* coincides with the end of the combination square when everything is level. The eccentric is then clamped and the keyway laid out or the amount of off-set determined. Experience has shown that where this method is carefully carried through there will be no need of changing the eccentric after the wheels are under the locomotive and the valves will properly tram so far as the amount of lap and lead is concerned.

ACCIDENT PREVENTION

The American Museum of Safety recently awarded the Pennsylvania Railroad a medal for being the industrial company that did the most for the protection of the lives and limbs of its workmen by means of safety devices for dangerous machines and processes, as was mentioned in the February issue of the *American Engineer*. This road, during the past year, has

Fig. 1—Exposed Lathe Gears Liable to Cause an Accident.

reduced the accidents in its shops from 8.7 per 1,000 employees in a month to 3.5 per 1,000. These accidents include everything from a scratched finger to a fractured skull.

That many of the accidents were unnecessary and due to shear carelessness was the belief of the Pennsylvania officials and in November, 1910, a vigorous campaign of education was begun among the employees. At that time experts were employed to show the company just how and what safety devices should be installed and the benefits derived from this work were so marked that frequent inspections have become the policy. The accompanying illustrations show some of the devices installed. Fig. 1 shows the unprotected gear wheels, at the end of a lathe. An employee passing by the running gears is liable to have his clothing caught and in this way suffer an accident. Fig. 2 shows the gears fully encased. A door is placed on the end so that

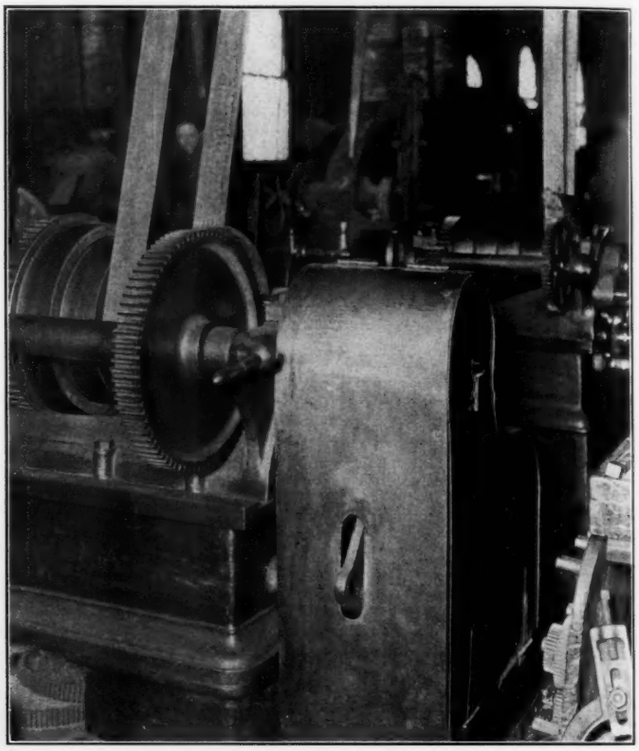


Fig. 2—Lathe Feed Gears Enclosed Insuring Absolute Protection.

the gears may be readily changed. Fig. 3 shows other safety devices as applied to the driving belts of a radial drill and the

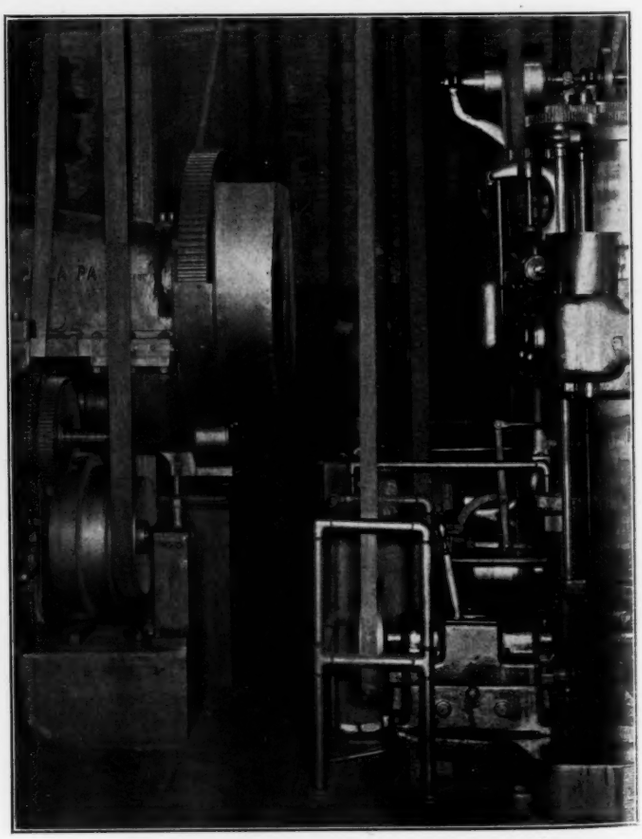


Fig. 3—Safety Appliances Applied to a Drill Press and Slotter.

driving gear of a large slotting machine, the belts being enclosed within a pipe railing and the gears being sufficiently covered by a sheet iron case. The following table shows the decrease in accidents throughout the year 1911:

Month. 1911—	Number of shop employees.	Killed.	Serious injuries per 1,000 employees.
January	34,127	4	8.7
February	34,171	7	7.3
March	32,899	0	8.3
April	31,380	1	6.0
May	34,694	3	7.9
June	34,601	1	5.2
July	31,641	2	4.7
August	32,512	2	3.4
September	32,932	0	3.4
October	33,462	0	3.2
November	33,997	2	3.5

These results are said to have been accomplished on a most economical basis. The reports resulting from inspections contained in all 3,126 recommendations covering improvements or changes in 3,737 tools or machines, at an estimated cost of $35,000, or an average of $530 for each shop. At one shop for which 238 recommendations were made, 157 covered improvements made with practically no cost.

Shopmen themselves have the most at stake in the accidents and the organization of a shop safety committee of the rank and file has proved invaluable. As the road reports: "The prevention of industrial accidents depends largely on the care exercised by the individual workman. By serving on the safety committees they become interested in precautions and will instinctively avoid many of the common and preventable dangers." Inquiry develops that even laborers serve on these committees of protection.

A terminal division committee is composed of a locomotive inspector, a brakeman, baggage porter, track foreman, yard foreman, usher, and relief assistant trainmaster. A road and yard committee is composed of a passenger engineman, freight conductor, inspector of car repairs, telegraph operator and a laborer. These are standing committees, the members of which are changed from time to time. The recommendations which they make are simple and cover a wide range of subjects.

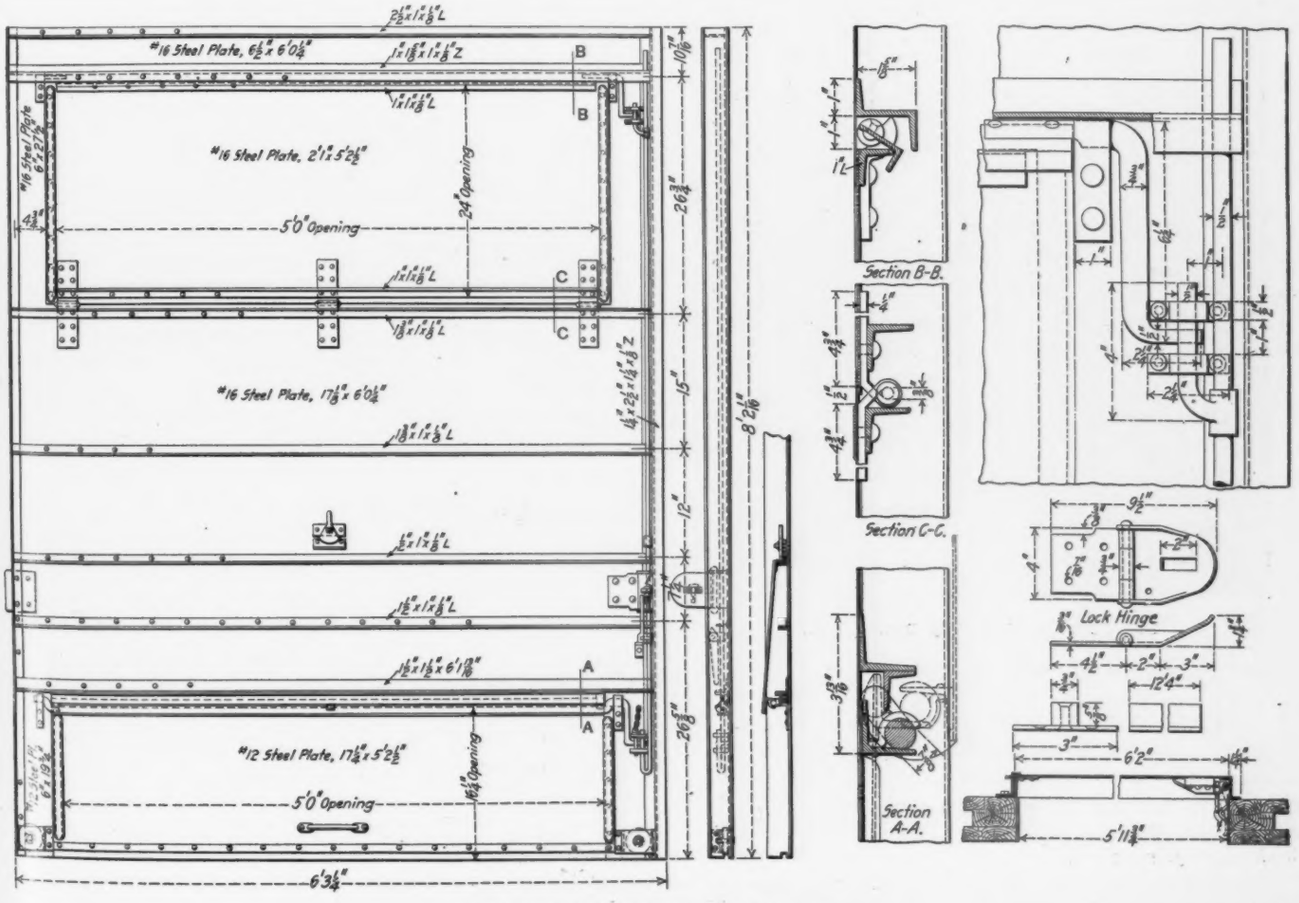
There are now 33 committees, including 148 men, on the various divisions. The committees report monthly to the superintendent, who forwards the report to the general superintendent, who, in turn, reports to the general manager every three months.

CHRISTY STEEL BOX CAR DOOR

The Christy box car door, illustrated herewith, is a combined side door and grain door, is made entirely of steel and is fixed permanently to the car. It is a wide departure from ordinary practice used heretofore. The fixed grain doors which were formerly used were so expensive for maintenance that they were gradually abandoned and temporary doors substituted. Temporary doors are stolen and destroyed in such large numbers that the expense for them has also become a large item in the freight car repair account. The ordinary side door, when made of wood and with ordinary fixtures, has many defects; it frequently gets out of order and also causes a large expense for maintenance.

For these reasons, the permanent improved steel door here illustrated will be regarded with unusual interest. It has been used in regular service on the Rock Island for nearly two years. Sample doors have also been used experimentally on the Chicago & North Western and the Lake Shore & Michigan Southern, and fifty cars now building at Pullman for the Michigan Central will be equipped with it.

The door slides on the inside of the car and thus avoids the danger to passenger trains which sometimes occurs when the outside doors hang loose. It is well protected and is not liable

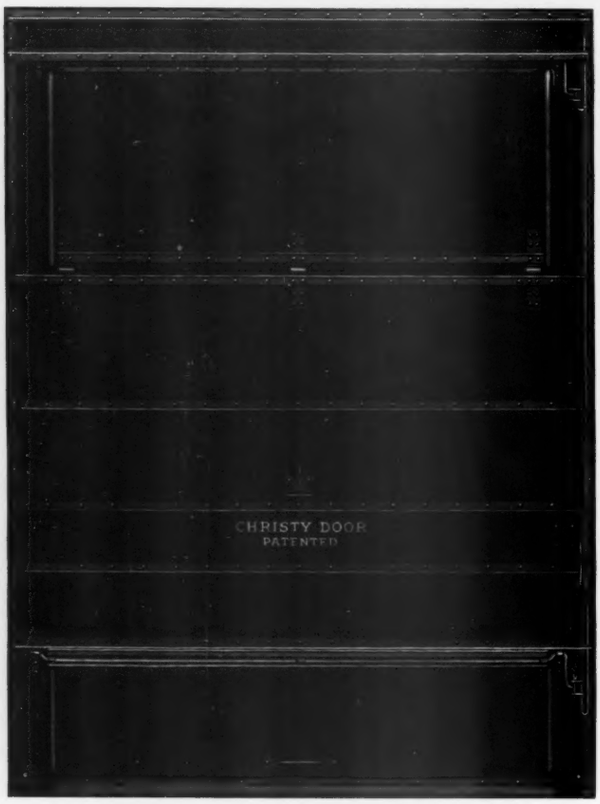


Details of Christy Steel Box Car Door.

to be injured by outside forces. The fixtures are so substantial and well arranged that they do not permit of pilfering, and the door is so tight that there is no loss from leakage of grain or damage from driving rain. It also has advantages in loading and unloading. A full car of grain can be completely unloaded and swept out in 28 minutes from the time the car is delivered at the elevator, while it often takes this long to open the doors and get the shovels ready for unloading.

The main door is made of No. 16 steel plate reinforced by angle irons of different sections and weights, as indicated on the drawing. In order to render the door satisfactory for the shipping of grain, coal or similar freight, it has two separate doors or ports, 60 in. wide, provided with simple and secure fastenings, permitting their easy and rapid operation. The upper door is 24 in. high and is hinged at its lower margin 5 in. above the grain line, and is large enough to admit the spouts used in loading grain and coal. The lower door, 16¼ in. wide, is hinged at its upper border and when opened permits the free discharge through it of all such freight as grain, coal, etc., without opening the main door. This lower door is likewise planned with special reference to the use of such power scoops or scrapers as are in general use at elevators and elsewhere for unloading grain, coal and similar substances from cars. When the smaller doors or ports are closed and fastened the main door, of course, acts as a rigid whole.

For freight which has to be passed through the main doorway,

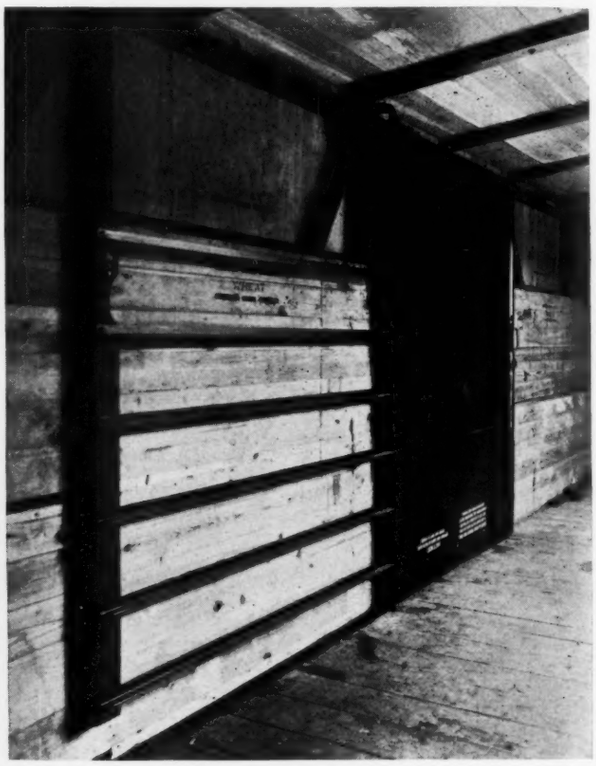


Outside View of Christy Door Closed.

guards are provided to prevent packages from getting behind the door and thus preventing it from being opened. When the door is closed it completes the side wall of the car, making that part as strong as the other side walls, and all kinds of freight may be loaded against it, thus making available the entire cubic space of the car. The box car side doors now in use will not sustain any pressure from within; therefore, no freight of any kind can be loaded against them.

The photographic illustrations show the construction of the doors clearly. The upper one operates on plain strap hinges which extend out sufficiently to make the door clear the adjacent angle irons. The sides are made tight by lapping over the half round molding which stiffens the side of the main door, and the top is made tight by the use of hinged angle irons, which are shown in section at *B-B*.

The lower door is hinged on a long ⅞ in. round bar, which is offset so as to work like an eccentric and throw the door out and make it clear the adjacent angle irons. The section at *A-A* shows the angle iron on the top of the lower door underlapping an adjacent angle, which is secured to the stiffener of the



Interior View of Car Showing Christy Door Closed.

main door. In this way the top of the main door is made proof against the weather. The whole door rolls on a floor track made of ¾ in. square iron, and passes into the car where it is held in a pocket protected by six angle irons.

One of the illustrations shows the interior of the car with the door closed. When the door is closed both top and bottom auxiliary doors are fastened and sealed by a vertical rod which extends between the two doors and passes into sockets at the top and bottom of the door frame. A detail of this fixture is shown on the drawing. The other attachments which are connected with the sealing of the car are now being developed and can be better understood by an examination of the door with its fixtures in operation. This improved steel door, which combines the side door with the grain door in permanent form, was invented by H. A. Christy, 1447 Marquette building, Chicago.

Ozonized Air for Subway Ventilation.—The Central London Railway, England, which has for the past 11 years ventilated the subway on the exhaust system, has recently decided to install a continual influx system with fresh air treated with ozone to purify and improve its quality.

U. S. Foreign Commerce.—The statement of exports and imports made up by the Department of Commerce and Labor for the month of February shows increases over February, 1911, on both sides. The value of imports increased from $121,694,000 to $134,207,000; exports from $173,304,000 to $196,821,000.

GENERAL NEWS SECTION

The Western Weighing Association has issued a new form of triangular card which is to be placed on all foreign line cars where the actual light weight varies 500 lbs. or more from the stenciled tare.

All of the Master Car Builders' rules of interchange went into effect on May 1 without exception on all of the St. Louis terminal lines, following the adoption of a similar practice in Chicago on April 1.

A special train of mail cars, which arrived at Oakland, Cal., from the East over the Southern Pacific on April 5, delivered 350 tons of mail, the trains for several days having been detained by floods in Nebraska and east of there.

The leetures on First Aid to the Injured, given for the benefit of the employees of the Pennsylvania Railroad during the past year, numbered 270, and the attendance at these lectures aggregated 9,180 employees. Many local firemen and policemen also attended these classes.

George Sherwood Hodgins, who has been a frequent contributor to the *American Engineer,* has been engaged by the commissioners of the National Transcontinental Railway of Canada to make a special report concerning the shops and equipment of the various engine houses, terminal shops, etc., on that road.

At a meeting of the legislative committee of the four principal railway brotherhoods at San Antonio, Tex., on April 11, resolutions were passed protesting against the policy of the Mexican government in discriminating against American railway employees in an alleged effort to eliminate them from the service of the Mexican railways for the purpose of replacing them with Mexicans.

The stoppage of work in the anthracite coal mines was followed by the laying off of large numbers of trainmen on the Philadelphia & Reading. At the shops of the Erie at Hornell, N. Y., 700 of the 1,000 employees were laid off because of the expected diminution of the volume of coal traffic on the company's lines; and a similar suspension of work was ordered at the shops at Salamanca, N. Y., and Meadville, Pa.

In an article by Edward B. Phelps in the *American Underwriter* it is stated that the accidents to railway employees cost the railways 1.24 per cent. of their wages during the years 1908-1910. Mr. Phelps states further that a good fair estimate of the cost that the proposed bill before the U. S. Congress for the protection of interstate railway employees would inflict on the railway companies would be only 1.50 per cent. of the wages paid.

A meeting of the representatives of the machinists', blacksmiths', carmen's, boilermakers' and sheet metal workers' organizations on western railways was held recently at Kansas City, Kan., for the purpose of organizing a federation of shop employees of all railways west of the Mississippi river. The movement is an outgrowth of the organization of federations of the employees of the Illinois Central and the Harriman lines, which led to the shop strike last fall.

The twenty-third annual report of the Relief Department of the Chicago, Burlington & Quincy, for the year ending December 31, 1911, shows an expenditure during the year of $621,165.34 in benefit orders to employees of the company. This was more than was received in contributions from members, and the company advanced $38,262.76. Since the establishment of the fund in 1889 there has been paid in benefit orders to employees on account of sickness and accidents a total of $8,240,184.67. The payments by the railway company have amounted to $1,458,211.

Anatole Mallet, Paris, France; Dr. Carl Gustav Patrick De Laval, Stockholm, Sweden, and Dr. Rudolf Diesel, Munich, Germany, have been elected to honorary membership in the American Society of Mechanical Engineers. Anatole Mallet has been engaged in developing various mechanical problems since 1867, among which are steam engines with double expansion and the application of this system to locomotives. Dr. De Laval in his earlier years did important work in developing processes for the manufacture of steel, but is best known through his invention of the centrifugal cream separator and other apparatus for the use of dairies and the De Laval steam turbine. Dr. Diesel is widely known as the inventor of the Diesel engine.

B. A. Worthington, receiver of the Wheeling & Lake Erie, has established safety committees similar to those on the Chicago & North Western and other roads. A central, or advisory, committee is made up of H. T. Douglas, Jr., chief engineer, chairman; C. C. Needham, tax commissioner, vice-chairman; J. G. Code, superintendent; C. W. Coe, superintendent; J. E. O'Hearne, master mechanic; C. S. Morse, master car builder; J. F. Marshall, purchasing agent and C. H. Holmes, secretary to the receiver. Sub-committees meet every month and draw up recommendations which are presented to the central committee. Employees are requested to report any dangerous conditions to their superior officers or to any member of the sub-committees.

The simple Mallet locomotive which was recently built for the Pennsylvania Railroad by the American Locomotive Company, and illustrated in the March issue of the *American Engineer,* page 150, is reported to have made a splendid record run from Altoona to the mountain top on Saturday, March 30. A train of 1,125 tons was pushed up the mountain by the engine at an average speed of ten miles an hour. The total train resistance was figured at 1,898 tons, and the two H8 type (consolidation) engines at the front of the train pulled a trifle more than 700 tons. The Mallet used 6,000 gal. of water and 9,000 lbs. of coal, while the other engines used 4,500 gal. of water and 6,000 lbs. of coal. The mechanical stoker on the Mallet proved to be 90 per cent. efficient.

Two hundred and fifty delegates, representing the Brotherhood of Railway Car Men, the Brotherhood of Boilermakers and Helpers, the Brotherhood of Blacksmiths, the International Association of Sheet Metal Workers, and other shopmen's organizations, at a meeting at Kansas City on April 22, organized the "Federation of Federations," to represent the shop workmen employed on 47 lines west of the Mississippi river. The Federation claims 300,000 members. On the second day of their meeting they prepared and sent to President Taft a telegram notifying him that they had decided "to extend or to make preparation to extend" to all the railways in the West the strike on the Harriman Lines and the Illinois Central, which they started last year, "unless a settlement of an honorable character can be secured." They claim that their constituents are determined and that the other railways are assisting the Harriman Lines; and it is declared that boiler explosions are becoming more frequent. The president of the Federation of Federations is W. O. Horton, of St. Louis; vice-president, G. W. Pring, Des Moines; secretary, John Scott, San Francisco. The first of the eleven names signed to the telegram sent to President Taft is James W. Kline.

The Central Safety Committee of the Chicago & North Western reports that for the 15 months ending April 1, 1912, the number of passengers killed on that road, as compared with the preceding period of 15 months (ending December 31, 1910) fell off 57 per cent. The number of employees killed fell off

23 per cent., and of other persons 11 per cent. Injuries (not fatal) also showed marked diminutions. Other decreases for these two periods are as follows:

			Per Cent.
25	fewer	trainmen killed	53.2
1,790	"	trainmen injured	44.5
5	"	switchmen killed	26.3
132	"	switchmen injured	16.5
1	"	stationmen killed	25.0
120	"	stationmen injured	14.7
940	"	trackmen injured	42.7
120	"	bridgemen injured	29.8
5	"	car repairers killed	71.4
13	"	car repairers injured	3.5
1	"	shop and engine house men killed	14.3
214	"	shop and engine house men injured	13.2
1	"	other employees killed	7.7

There was an increase of 7 trackmen killed, 2 bridgemen killed, and 13 other employees injured.

The educational bureau of the Illinois Central has announced the company's plan for paying employees for useful ideas. It is a combination of the Pennsylvania Railroad's plan, with the added offer to recognize and pay for suggestions that are in use only locally. Each employee is offered the opportunity to present to the educational bureau for consideration any idea he may have thought out or worked out for promoting the interests of the company in any manner. Such ideas may be original in so far as the company is concerned, may be adoptions of plans that have been heard of or that may be in effect on some other railway, or may be descriptions of quick and economical ways and means of doing various kinds of work, which have been put into practice locally and which have proved that they were successful. The bureau calls attention to the wide field for suggestions. It may be a plan some foreman has for reclaiming scrap material or repairing tools, it may be a handy device some shop machinist has put into use, it may be a system some yard clerk has worked out, it may be a method some agent or conductor has for handling passengers or freight in a manner to win praise for the company. The advisory board of the educational bureau will pass on and judge all suggestions offered. Such suggestions as are deemed suitable for adoption will be properly recommended and presented to the management. If the management accepts a suggestion and puts it into effect, the advisory board will then decide on a fair and proper recompense to be made to the employee.

The Special Committee on the Relations of Railway Operation to Legislation has issued Bulletin 29, containing a full report of the conference committee, which co-operated with the post office department in formulating uniform specifications for steel postal cars. The most important change from the original specifications, was increasing the section moduli of the vertical end members from 35 to 65. Paragraph 29 referring to the floor was also changed to read as follows: "Sub-floor of postal cars to be of iron or steel plate, upper or wearing surface to be of matched wooden flooring, maple or rift-sawed yellow pine or fir, laid longitudinally; or a composition, preference being in the order named. If a composition is used, the wearing surface between the doors and the standing surface in front of letter tables and paper racks shall be of wood, cork or other suitable material. Proper insulation, including air space, should be provided between upper and lower courses. Floor strips for wood upper course should be bolted to sub-floor. Composition flooring may be secured by corrugated, keystone, or equivalent style of plate or by wire fastening, anchored to sub-floor." The bulletin also contains specifications covering fixtures in mail cars, which were prepared by the post office department committee. The latter includes detailed descriptions of the distributing tables under letter cases, letter cases, racks for sacks and pouches, paper distributing tables and dumping tray, paper boxes in all mail cars, small cases for slips, portable bins for letter packages, gage for registered mail, order box, hoppers, lavatory, water tanks, wardrobe and mirror, wrecking tools, fire extinguishers, gas plate or steam cooker, cots, stools, deodorants and disinfectants, toilet paper, door fixtures, lighting, rakes for paper boxes, catcher arms, safety bars, cinder guards, safety rods, letter drops and movable stanchions. Both the specifications for the construction and for the fixtures have been referred to the second assistant postmaster general for appproval.

MEETINGS AND CONVENTIONS

Railway Storekeepers' Association.—The annual convention of this association will be held at the Hotel Stattler, Buffalo, N. Y., May 20-22. The committees will report on the following subjects: Recommended Practices; Piece Work; Scrap Classification; Accounting; Uniform Grading and Inspection of Lumber; Standard Grain Door; Apprenticeship; Stationery; and Standardization of Tinware. J. P. Murphy, secretary, Box C, Collinwood, Ohio.

International Railway Fuel Association.—The annual convention of this association will be held at the Hotel Sherman, Chicago, May 22-25. The program will include the following papers: Standard Locomotive Performance Sheet; The Use of Anthracite for Locomotive Fuel; Drafting of Locomotives; Proper Method of Firing Locomotives; Inspection of Fuel and a special paper by Dr. W. F. M. Goss, University of Illinois. D. B. Sebastian, secretary, La Salle street station, Chicago.

Air Brake Association.—The annual convention of this association will take place May 7-10 at the Hotel Jefferson, Richmond, Va. The subjects to be discussed are as follows: Recent Tests of Brake Shoes; The Cleaning Date; Westinghouse P. C. Equipment in Service; Report of the Committee on Air Hose Failures; the New York L. T. Equipment; Right-Angled Pipe Fittings in Air Brake Service; report of committee on Recommended Practice; the Westinghouse P. C. Equipment; Questions and Answers. F. M. Nellis, secretary, 53 State street, Boston, Mass.

M. M. and M. C. B. Conventions.—Following its usual custom, the Pennsylvania lines will provide a special train, to be known as the Master Car Builders' special, for the accommodation of delegates to the conventions of the American Railway Master Mechanics' Association, the Master Car Builders' Association and the Railway Supply Manufacturers' Association, to be held at Atlantic City, N. J., June 12-19. The train will leave Chicago at 3 p. m., Monday, June 10, and will arrive at Atlantic City at 2 p. m. on the following day. Summer tourist rates will be

RAILROAD CLUB MEETINGS

Club.	Next Meeting.	Title of Paper.	Author.	Secretary.	Address.
Canadian	May 13	Annual Meeting and Election		Jas. Powell	Room 13, Windsor Hotel, Montreal.
Central	May 10	Wireless Train Control	Frank Wyatt Prentice	H. D. Vought	95 Liberty St., New York.
New England	May 13			Geo. H. Frazier	10 Oliver St., Boston, Mass.
New York	May 17	Automatic Brake Slack Adjusters	W. H. Sauvage	H. D. Vought	95 Liberty St., New York.
Northern	May 24			C. L. Kennedy	401 Superior St., Duluth, Minn.
Pittsburgh	May 18	Vaudeville Entertainment		J. B. Anderson	Union Station, Pittsburgh, Pa.
Richmond				F. O. Robinson	C. & O. Ry., Richmond, Va.
S'th'n & S. West'n	May 16	Cast Steel Tender Frames		A. J. Merrill	218 Grant Bldg., Atlanta, Ga.
St. Louis	May 10	The Local Freight Agent	R. O. Wells	B. W. Frauenthal	Union Station, St. Louis, Mo.
Western	May 21	Annual Meeting		Jos. W. Taylor	390 Old Colony Bldg., Chicago, Ill.

charged. Accommodations may now be reserved at the ticket office at 242 South Clark street, Chicago, and may be held until June 3.

Master Boilermakers' Association.—The annual convention of this association will take place at the Fort Pitt Hotel, Pittsburgh, May 14 to 17. The subjects to be considered are: The Best Method of Applying and Caring for Flues; Steel vs. Iron Flues; Best Method of Staying the Front Portion of Crown Sheet on Radial Top Boilers; Advantages or Disadvantages of Fire Brick Arches and Arch Tubes; Circulation in Marine Return Tubular and Vertical Boilers; Advantages and Disadvantages of Oxy-Acetylene Process in Making Repairs to Boilers; Apprenticeship; Location of Feed Water Admission; When Is a Locomotive Boiler in Its Weakest Condition; Smoke Prevention and Spark Arrestors, and the Relation of Superheated Steam to the Upkeep of the Boilers. H. D. Vought, secretary, 95 Liberty street, New York.

ATLANTIC CITY CONVENTIONS

J. W. Taylor, secretary of the Master Mechanics' Association and the Master Car Builders' Association, has sent out to members a circular letter giving details regarding the entertainment features in connection with the conventions of these associations, which will be held in Atlantic City, June 12-19, inclusive. The announcement comes from Mr. Taylor this year rather than from the Railway Supply Manufacturers' Association, because, as Mr. Taylor's letter shows, the railway associations this year are contributing towards the expense of the entertainment features.

A charge of $1 will be made for each badge issued to the members of the Master Car Builders' Association, in order to raise money with which to defray that association's portion of the expense, while no similar charge will be made for badges for the Master Mechanics' Association. The reason for this is that the Master Car Builders' Association, being an organization whose members represent the railways themselves, and whose expenses are paid by the railways, has no fund from which to meet this class of expenses, while the membership of the Master Mechanics' Association, being an individual affair of the members, and the money for its support being furnished by them, it can properly take the funds for this purpose from its treasury.

Mr. Taylor's letter is as follows:

At a meeting of the Joint Committee on Arrangements for the conventions in June, it was agreed that the expense connected with entertainments, procurement of badges, and such other details as are necessary in connection with the convention, should be borne by the three associations interested, viz.: Railway Supply Manufacturers' Association, Master Car Builders' Association and the American Railway Master Mechanics' Association on the following basis:

Music—Daily orchestra concerts on steel pier, Supplymen's Association. Informal dancing, one-third each. Incidental expenses in connection with informal dancing, 70 per cent. by Supplymens' Association, 30 per cent. by the other two associations. Musical entertainment, 70 per cent. by Supplymen's Association, 30 per cent. by the other two associations. Ball game, one-third each. Badges, cost to each association.

Inasmuch as these expenses are personal in character, being intended for entertainment purposes only, and not such as should be borne by the association, it has been decided, in order to provide a fund to meet them, that there be collected from each member at the time he registers and procures badges for himself, members of his family and guests, the sum of $1 for each badge so procured, the fund thus obtained to be used under the direction of the Joint Committee on Arrangements in paying the above expenses.

The above arrangements for procurement of badges applies only to the Master Car Builders' Association, the Master Mechanics' Association badges being procured as formerly.

The free use of roller chairs has been dispensed with, but arrangements have been made with the Reed and Shill Chair Companies that coupon books will be provided as the following rates: Ten rides, $2.50 each; 20 rides, $5 each.

When the tickets are used, the book covers will be redeemed when presented to the chair companies, with a refund of 50 cents each on the ten-ride book and $1 each on the twenty-ride book.

The following entertainment features have been provided:

Wednesday, June 12.

10:30 a. m.—Orchestra concert on Million-dollar Pier.
3:30 p. m.—Orchestra concert on Million-dollar Pier.
9:00 p. m.—Social gathering and informal dancing, Marlborough-Blenheim hotel.

Thursday, June 13.

10:30 a. m.—Orchestra concert on Million-dollar Pier.
3:30 p. m.—Orchestra concert on Million-dollar Pier.
9:30 p. m.—Informal dancing on Million-dollar Pier.

Friday, June 14.

10:30 a. m.—Orchestra concert on Million-dollar Pier.
3:30 p. m.—Orchestra concert on Million-dollar Pier.
9:00 p. m.—Musical program.

Saturday, June 15.

10:30 a. m.—Orchestra concert on Million-dollar Pier.
2:00 p. m.—Baseball; parade from Million-dollar Pier to street cars.
3:00 p. m.—Annual baseball game.
No scheduled entertainment in the evening.

Sunday, June 16.

No scheduled entertainment.

Monday, June 17.

10:30 a. m.—Orchestra concert on Million-dollar Pier.
3:30 p. m.—Orchestra concert on Million-dollar Pier.
9:00 p. m.—Informal dancing, Marlborough-Blenheim hotel.

Tuesday, June 18.

10:30 a. m.—Orchestra concert on Million-dollar Pier.
3:00 p. m.—Orchestra concert on Million-dollar Pier.
9:00 p. m.—Informal dancing on Million-dollar Pier.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass. Convention, May 7-10, Hotel Jefferson, Richmond, Va.

AMERICAN RAILWAY MASTER MECHANICS' ASSOC.—J. W. Taylor, Old Colony building, Chicago. Convention, June 17-19, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—M. H. Bray, N. Y., N. H. & H., New Haven, Conn. Convention, July 9, Chicago.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., New York. Spring meeting, May 28-31, Cleveland, Ohio.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago. Convention, May 22-25, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, Brown Marx building, Birmingham, Ala. Convention at Chicago, July 23-26, 1912.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio. Convention, August 15, Chicago.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York. Convention, May 14-17, Fort Pitt Hotel, Pittsburgh, Pa.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago. Convention, June 12-14, Atlantic City, N. J.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOC. OF U. S. AND CANADA.—A. P. Dane, B. & M., Reading, Mass. Convention, September 10-13, Denver, Col.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio. Convention, May 20-22, Statler Hotel, Buffalo, N. Y.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y., August, 1912.

PERSONALS

GENERAL.

W. P. Hawkins, fuel inspector of the Western Maryland, has resigned to go with the Missouri Pacific.

W. L. Scott has been appointed motive power inspector of the Pennsylvania Lines West of Pittsburgh, at Columbus, Ohio, vice C. S. White, promoted.

J. B. Kapp has been appointed assistant master mechanic of the Allegheny division of the Pennsylvania Railroad, with headquarters at Oil City, Pa.

W. J. Hurley, formerly road foreman of engines of the New York Central, has been appointed chief examiner of firemen for promotion in the western district.

W. J. Tollerton, assistant general superintendent of motive power of the Rock Island Lines at Chicago, has had his official title changed to mechanical superintendent.

D. J. Sisson, formerly engine driver of the Empire State express on the New York Central, has been appointed chief examiner of firemen for promotion for the eastern district.

S. W. Mullinix, superintendent of motive power of the Rock Island Lines, second district, with office at Topeka, Kan., has had his official title changed to district mechanical superintendent.

J. B. Kilpatrick, superintendent of motive power of the Rock Island Lines, first district, with office at Davenport, Iowa, has had his official title changed to district mechanical superintendent.

C. M. Taylor, superintendent of motive power of the Rock Island Lines, third district, with office at El Reno, Oklahoma, has had his official title changed to that of district mechanical superintendent.

J. A. Gibson, formerly master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis at Urbana, Ill., has been appointed combustion engineer of the Illinois Traction System, with headquarters at Urbana.

H. H. Honaker, master mechanic of the Frisco system, has been transferred from Birmingham, Ala., to Ft. Scott, Kan., where he will have charge of the mechanical work of the Northern division of that road.

J. E. Fitzsimons, road foreman of engines of the Central Vermont of St. Albans, Vt., has been appointed acting superintendent of motive power and car department, with office at St. Albans, succeeding T. McHattie, resigned.

H. A. English has been appointed locomotive inspector of the Canadian Northern, with office at Winnipeg, Man. He will supervise the examination of enginemen and report to the superintendent of rolling stock on matters pertaining to locomotive operation.

T. McHattie, who recently resigned as superintendent of motive power and car department of the Central Vermont, has been appointed master mechanic of the Eastern division of the Grand Trunk, with office at Montreal, Que., succeeding J. Duguid, assigned to other duties.

W. L. Robinson, former special inspector of the mechanical department of the Baltimore & Ohio, has been made road foreman of engines of the Baltimore division, at Baltimore. Mr. Robinson is a graduate of Purdue University, and entered the service of the Baltimore & Ohio as a special shop apprentice. He afterwards became engine house foreman at Garrett, Ind., from which position he advanced to special inspector of the mechanical department. Upon the organization of the Baltimore & Ohio safety campaign, Mr. Robinson was appointed on the general committee representing the mechanical department, and through his interest in the movement a number of important safety devices were adopted in the shops.

Pearl F. Smith, chief draftsman of the Chicago, St. Paul, Minneapolis & Omaha, at St. Paul, Minn., has been appointed mechanical engineer, with office at St. Paul. Mr. Smith was born in 1878, and was graduated from the St. Paul high school in 1898. Four years later he went in the drawing room of the Northern Pacific and served on that road from 1902 to 1905 as tracer and draftsman. He then went with the Louisville & Nashville as draftsman and drawing room foreman. His service with this road extended from 1905 to 1907, when he resigned to go with the Chicago, St. Paul, Minneapolis & Omaha as chief draftsman, serving the later in that capacity until his recent appointment. Mr. Smith was a contributor to the *Railway Age Gazette* Shop Section, having participated in the shop kink competition, which closed January 15, 1911.

Pearl F. Smith.

V. C. Randolph has been appointed master mechanic of the Erie, with office at Avon, N. Y. He was born on October 19, 1869, at Randolph, N. Y., and was educated in the common schools at Salamanca. He began railway work in March, 1882, as a machinist apprentice on the New York, Lake Erie & Western, now the Erie, and after completing his apprenticeship he worked as a machinist until July, 1886, when he went to the Allegheny division as locomotive fireman, and was made an engineman in April, 1891. He remained in that position until July, 1902, and then became locomotive and air-brake instructor at the International Correspondence Schools of Scranton, Pa. In November, 1904, he returned to the service of the Erie as general air-brake instructor, and was promoted in January, 1910, to supervisor of locomotive operation of the Allegheny and Bradford divisions, which position he held at the time of his recent appointment as master mechanic of the Rochester division of the same road.

V. C. Randolph.

CAR DEPARTMENT

W. Gillespie has been appointed master car builder of the Central Vermont, with office at St. Albans, Vt.

C. E. Dum has been appointed car foreman of the Denver & Rio Grande at Hoisington, Kan., vice A. L. Latham, resigned.

D. C. Ross has been appointed master car builder of the Michigan Central, with office at Detroit, Mich., vice J. A. Chubb, deceased.

P. KASS, formerly of the Pullman Company, has been appointed general car foreman of the Fifty-first street yards of the Chicago, Rock Island & Pacific, vice C. Anderson, resigned.

O. J. PAGE has been appointed general car foreman of the Arkansas division of the Chicago, Rock Island & Pacific, with headquarters at Argenta, Ark., vice C. H. Westfall, resigned on account of ill health.

SHOP

J. D. LEWIS has been appointed gang foreman of the Denver & Rio Grande at Salida, Colo., vice T. A. Owen, resigned.

E. J. NEUNAN has been appointed foreman of the Norfolk & Western at East Radford, Va., vice T. L. Brown, transferred.

J. T. HEIDLER has been appointed general foreman of the Norfolk & Western at Bluefield, W. Va., vice J. W. Andrews, resigned.

R. L. BLACK has been appointed general foreman of the Norfolk & Western at Columbus, Ohio, vice J. T. Heidler, transferred.

P. E. BAUM has been appointed night engine house foreman of the Denver & Rio Grande at Salida, Colo., vice A. H. Asher, resigned.

H. F. JONES has been appointed foreman boilermaker of the Denver & Rio Grande at Salida, Colo., vice F. J. Gussenhoven, resigned.

T. L. BROWN has been appointed general foreman of the Norfolk & Western, with office at Kenova, W. Va., vice R. L. Black, transferred.

J. LYDDON, engine inspector of the Atchison, Topeka & Santa Fe, has been appointed engine house foreman of that road, at Barstow, Cal.

THOMAS MULVIHILL has been appointed foreman boilermaker of the Chicago, Rock Island & Pacific at Argentia, Ark., vice W. E. Keating.

W. E. ALLISON has been appointed night engine house foreman of the Norfolk & Western at West Roanoke, Va., vice T. H. Adams, transferred.

E. A. SWEELEY has been appointed foreman of the engine house and car department of the Chicago, Rock Island & Pacific at Invergrove, Minn., vice F. Coates, assigned to other duties.

PURCHASING AND STOREKEEPING

A. M. DARLOW, mechanical engineer of the Buffalo & Susquehanna at Galeton, Pa., has been appointed also general storekeeper.

C. F. PARKER, purchasing agent of the Illinois Central, and vice-president of the St. Louis, Belleville & Southern, with office at Chicago, has been elected also vice-president of the Central of Georgia.

G. E. SMITH has been appointed purchasing agent of the Louisiana Railway & Navigation Company, with office at Shreveport, La., succeeding C. L. Vaughn, superintendent of transportation and purchasing agent, resigned to accept service with another company.

OBITUARY

J. F. SIMPSON, foreman of the tin and pipe shops of the Southern Railway at Coster, Tenn., died in the Lincoln Memorial hospital April 11. Mr. Simpson had been with the Southern Railway for 25 years, and was 67 years old at the time of his death.

NEW SHOPS

ANN ARBOR.—Additions will be made to the shops at Owosso, Mich.

ATCHISON, TOPEKA & SANTA FE COAST LINE.—A 25-stall engine house and trackage, water and drainage system will be constructed at Barstow, Cal., at a cost of approximately $133,000, to replace the structures destroyed by fire June 23, 1911.

BALTIMORE & OHIO.—An electrical sub-station will be built at Mt. Clare, Baltimore, Md., to provide additional power required in the operation of shop machinery and in equalizing the distribution of electric current on the Baltimore Belt Line.

CANADIAN PACIFIC.—It is reported that $600,000 will be spent in terminal facilities at Coquitlam, B. C., which will include an engine house, car repair shops, machine shops, etc., and 25 miles of track. An addition is to be made to the engine house at Brandon, Man.

CHICAGO, MILWAUKEE & PUGET SOUND.—It is reported that improvements will be made to the Tacoma, Wash., car shop, which will nearly double its capacity.

CHICAGO, MILWAUKEE & ST. PAUL.—An engine house will be built at Aberdeen, S. Dak., at an estimated cost of $75,000.

ILLINOIS CENTRAL.—The repair shops at East St. Louis, which were recently burned, will be rebuilt at a cost of approximately $75,000.

KANSAS CITY SOUTHERN.—It is reported that plans have been made for the erection of a six-stall engine house, a 90-ft. turntable, a machine shop, a coaling plant, and other buildings for this road at Watts, Okla.

NORFOLK SOUTHERN.—It is reported that a new repair shop will be built at West Munden, Va., near south Norfolk. The land has been purchased, and it is expected that the work will be started this coming summer.

NORFOLK & WESTERN.—It is reported that plans are prepared for the new shops at West Munden, Va. The estimated cost is $500,000.

NORTHERN PACIFIC.—Contracts have been awarded for the construction of a new engine house and shop at Centralia, Wash.

SOUTHERN PACIFIC.—Plans are being prepared for larger car shops at Oswego, Oregon.

VIRGINIAN.—An officer writes that a contract has been given to the George B. Swift Company, Chicago, for building an erecting shop at Princeton, W. Va. The Roanoke Bridge Works has the contract for the steel work. The structure is to be 55 ft. high, 127 ft. 6 in. x 270 ft., and will be of steel and brick construction with gravel roof. The improvements will cost $80,000, not including one 20-ton and one 200-ton crane, which have been ordered from the Niles-Bement-Pond Company. The same contractors have been given a contract to build an extension to the stripping shop, 70 ft. x 100 ft., to cost about $12,000, to be used as a boiler shop. This building is to be of steel and brick construction, and will be equipped with a 30-ton crane. An additional contract has been given to the George B. Swift Company, for the foundations for a transfer table, 75 ft. x 410 ft., to cost about $13,500, and to the Whitney Foundry & Equipment Company for the table.

WESTERN MARYLAND.—Contracts have been given to the Roberts & Schaefer Company, Chicago, for four large Holman locomotive coaling stations to be built at Hagerstown and at Cumberland, Md., at Rockwood, Pa., and at West Virginia Central Junction, W. Va. Two of the stations will be of 500 tons capacity, and are to be built to span and coal on four main-line tracks, having 24 ft. centers.

Supply Trade Notes

The American Locomotive Company is making additions to its plant at Montreal, Can.

The Cambria Steel Company, Johnstown, Pa., has moved its Chicago office to 1860 McCormick building.

The Laconia Car Company, Boston, Mass., has moved its general offices from 141 Milk street to 60 Congress street.

L. R. Romeroy, consulting engineer, has moved his office from 30 Church street, New York, to 105 West Fortieth street.

The Lima Locomotive & Machinery Company, Lima, Ohio, will construct a two-story machine shop, 150 ft. x 350 ft.

The Harlan & Hollingsworth Corporation of Wilmington, Del., has awarded a contract for the erection of a large steel car shop.

The Railway Materials Company, Chicago, has moved its general office from the Old Colony building to the Railway Exchange.

Edgar Allen & Company, Limited, Chicago, steel manufacturers, has moved its office to larger quarters at 718-722 West Lake street.

The O'Malley-Beare Valve Company, Chicago, maker of the Multiple line of valves, has moved its general office to 333 Railway Exchange.

The Scullin-Gallagher Iron & Steel Company, St. Louis, Mo., has moved its New York office from 1 Wall street to the Grand Central Terminal.

R. L. Langtim has been appointed mechanical superintendent of the Western Railway Equipment Company, St. Louis, Mo., with office in that city.

H. M. Baxter, formerly with the Wolfe Brush Company, Pittsburgh, Pa., has been appointed manager of the railway department of the Kip Brush Company, New York City.

Herbert Wolff, mechanical engineer of the American Car & Foundry Company, New York, has been made assistant to Vice-President J. M. Buick, with office in St. Louis, Mo.

The Toledo Machine & Tool Company, Toledo, Ohio, has closed contracts for a three-story steel and brick building, 90 ft. x 115 ft., which will be added to its present plant.

C. E. Thomas has resigned his position as general foreman of water works of the Illinois Central, to go with the Central Material & Construction Company at Mt. Pulaski, Ill.

George F. Stalley, purchasing agent of the Browning Engineering Company, Cleveland, Ohio, has also been made advertising manager of that company, vice L. C. Pelott, resigned.

The railway sales department of John Lucas & Co., Philadelphia, Pa., manufacturers of paints, has moved its Chicago office from the Old Colony building to 945 Peoples Gas building.

Gardner Cornett, vice-president of the American Steam Gauge & Valve Manufacturing Company, Boston, Mass., and manager of the New York office, is to make a business trip through England.

The Chicago office of the Niles-Bement-Pond Company, New York, has been moved from the Commercial National Bank building to the McCormick building, 332 South Michigan avenue, Chicago.

The Pennsylvania Tank Car Company, Sharon, Pa., has awarded the contract for the erection of a building 250 ft. x 40 ft. When completed the company will have increased its capacity to five finished cars a day.

Milliard P. Osbourn, formerly assistant sales manager of the Westinghouse Electric & Manufacturing Company, at Boston, Mass., has become a member of the firm of Samuel W. Green & Company, Springfield, Mass.

Robert E. Frame, who has been connected with the American Car & Foundry Company, New York, for several years, has resigned to become connected with the Haskell & Barker Car Company, Michigan City, Ind.

The American Sheet & Tin Plate Company, Pittsburgh, Pa., having completed a series of service tests extending over several years, is now making all roofing terne plates exclusively from copper bearing open hearth steel.

William H. Winterrowd, formerly assistant engineer in the mechanical department of the Lake Shore & Michigan Southern, has been appointed mechanical engineer of the Damascus Brake Beam Company, Cleveland, Ohio.

The American Railway Supply Company, New York, has moved its general office from 24 Park Place, to its new factory building at 134-136 Charles street. The company has been located at the former address for 22 years.

John H. Long, for the past eight years sales engineer for the William Tod Company, Youngstown, Ohio, has resigned to take a similar position with the United Engineering & Foundry Company. His headquarters will be in Youngstown.

Nathan Owitz has been appointed manager of the Cincinnati, Ohio, office of the Wheeler Condenser & Engineering Company, Carteret, N. J. Mr. Owitz has been in the sales department in the home office of this company for the past six years.

The Ralston Steel Car Company, Columbus, Ohio, is making extensive improvements to its plant by enlarging the buildings and adding new machinery. When these improvements are completed the company will have a capacity of at least 40 cars a day.

J. W. Mack, secretary and treasurer of the Nathan Manufacturing Company, New York, died April 11, following an operation. Mr. Mack had been secretary and treasurer of the Nathan company ever since its organization in 1883, when it succeeded Nathan & Dreyfus.

R. A. Dugan, formerly assistant general manager of the Southern Railway, has gone to the Scullin-Gallagher Iron & Steel Company, St. Louis, Mo., to take charge of the sales department of its Chicago office. The exact location of this office has not yet been determined.

The plant of the Buffalo Foundry & Machine Company, Buffalo, N. Y., was damaged by fire to the extent of $10,000 on April 11. The greatest damage was done to the roof, as the rest of the building was of practically fireproof construction. Work was only interrupted for four or five days.

Interests associated with the Nova Scotia Car Works, Halifax, N. S., have organized the Ontario & Western Car Company, Limited, with a capitalization of $5,000,000, and have announced the intention of erecting immediately a modern car-building plant at Port Arthur, Ont., to employ about 1,000 men.

Benjamin Guggenheim, president and director of the International Steam Pump Company, the Blake & Knowles Steam Pump Works, Henry R. Worthington, the Laidlaw-Dunn-Gordon Company, and the Power & Mining Machinery Company, all of New York, was lost at sea in the wreck of the White Star steamship Titanic, April 15.

The Reed-Prentice Company, Worcester, Mass., has recently been incorporated with $2,500,000 capital. This corporation is a merger of the following companies, all of Worcester: The F. E. Reed Company, manufacturer of lathes; the Prentice Brothers Company, manufacturer of geared head lathes and drills; the Reed Foundry Company, manufacturer of heavy ma-

chinery; the Reed & Curtis Machine Screw Company, manufacturer of machine screws and machine tools, and the Crompton Associates, manufacturers of heavy machinery and tools.

The Storrs Mica Company, Owego, N. Y., has taken the general agency for the railway trade of the Indestructible hose clamp, made by the Thompson Manufacturing Company, Newark, Ohio. These clamps are used on air brake, air signal, steam and water hose. Sales of this device will be in charge of Charles P. Storrs, manager of the railway department of the Storrs company.

At the annual stockholders' meeting of the Joseph Dixon Crucible Company, Jersey City, N. J., the retiring board of directors was unanimously re-elected and the following officers were elected for the ensuing year: President, George T. Smith; vice-president, W. H. Corbin; treasurer, George E. Long; secretary, Harry Dailey; assistant treasurer and assistant secretary, J. H. Schermerhorn.

The Greenfield Tap & Die Company, Greenfield, Mass., was organized in Boston on April 2 as a holding company. The capital of the company will consist of $1,000,000 preferred stock and $1,000,000 common stock. The company owns two-thirds of the stock of the Wiley & Russell Manufacturing Company, Greenfield, manufacturer of taps and dies, and a controlling interest in the Wells Brothers Company, Greenfield, also manufacturer of taps and dies, and expects soon to own the entire stock issue of the latter company.

The Pittsburgh Steel Foundry Company, Pittsburgh, Pa., has acquired all of the stock of the Pittsburgh Equipment Company, and the business of the latter company will hereafter be conducted under its name. The Pittsburgh Steel Foundry Company has increased its capital stock to $1,000,000, and is enlarging its plant to provide better facilities for designing and manufacturing the line of cast steel equipment for freight car bodies and freight car trucks, which was developed by the Pittsburgh Equipment Company.

The Joliet Railway Supply Company, Joliet, Ill., announces that in addition to the Perry anti-friction side bearings it has made arrangements for the exclusive manufacture and sale of the improved Hartman anti-friction center plate. In addition to its works at Joliet, the company is now equipping and will operate a large plant at Fortieth street and Princeton avenue, Chicago, to which point it will remove its general office from Joliet and its Chicago office from the Fisher building, maintaining sales offices only at the Karpen building, Chicago, Mutual building, Richmond, Va., and Syndicate Trust building, St. Louis, Mo.

On March 28, the United States District Court for the district of New Jersey, in an opinion by Judge Cross, handed down its decision in a suit of the Westinghouse Air Brake Company, Pittsburgh, Pa., vs. the New York Air Brake Company, New York. The complainant alleged that patent No. 912,511, covering the K-triple valve, and patent No. 912,512, for a check valve, had been infringed by the defendant. The court decided in favor of the complainant as to the K-triple valve patent, but dismissed the complaint as to the other patent, it being evidently of minor importance and value, and the court holding it invalid.

Abram E. Smith, mechanical engineer of the Union Tank Line Company, New York, has been appointed assistant master car builder, with office at New York, succeeding Thomas Beaghen, Jr., promoted. Mr. Smith was born in Hereford, Eng., on February 2, 1879, and entered the service of the Union Tank Line Company on February 12, 1902, as a stenographer and draftsman. During the period from 1902 to 1907, he attended the evening classes at the Cooper Institute, and later was graduated from the Cooper Union School of Science. On May 1, 1907, he was made mechanical engineer of the Union Tank Line Company, which position he held until his recent promotion

The National Tube Company, Pittsburgh, Pa., which recently sold $10,000,000 in bonds, will increase its capital stock from $9,000,000 to $13,000,000. This $4,000,000 stock will be bought at par by the Federal Steel Company, New York, which is a subsidiary of the United States Steel Corporation, and which now owns all the outstanding stock of the tube company. The proceeds of the sale of the bonds and stock will be used to reimburse the United States Steel Corporation and subsidiary companies of the corporation for money borrowed from them to pay for actual outlays, for additions and extensions to the National Tube Company's plant, and for working capital. When this readjustment has been made the National Tube Company will have no floating debt.

Arthur M. Kittredge has resigned as president of the Barney & Smith Car Company, Dayton, Ohio. Probably no successor will be elected until the annual meeting in June. Mr. Kittredge entered the service of the Barney & Smith Car Company in 1884 as salesman, and was appointed assistant superintendent in 1886. He was superintendent from 1888 to 1900, when he was elected vice-president. This office he held until November, 1908, when he was chosen president to succeed Colonel J. D. Platt. Mr. Kittredge is widely known among railway officers and manufacturers of railway equipment and is considered an authority on matters of car construction. He remains a member of the board of directors of the Barney & Smith Company, being also a director of many industrial and financial institutions. Since the organization of the Railway Business Association Mr. Kittredge has been very actively identified with its work and is now one of its vice-presidents.

Thomas Beaghen, Jr., assistant master car builder of the Union Tank Line Company, New York, has been appointed master car builder, with office at New York, succeeding Charles M. Bloxham, who has retired on account of ill health. Mr. Beaghen was born on April 20, 1876, in Hancock, Delaware county, New York. After graduating from the Hancock high school and taking several special courses in mathematics, chemistry, etc., he graduated from the Pratt Institute of Technology. He also took a special course of mechanical engineering at Lehigh University. He then entered the mechanical department of the New York Central, and later was connected with the American Steel Foundries Company and the United States Metal & Manufacturing Company. Mr. Beaghen entered the service of the Union Tank Line Company on March 15, 1909, as inspector of materials, and was made assistant master car builder on June 1, 1910, which position he held at the time of his recent appointment as master car builder.

John Mather Wallis, assistant to the president of the Safety Car Heating & Lighting Company, New York, since 1909, died of heart disease at his home at East Orange, N. J., April 5. Mr. Wallis was born at New Orleans, La., December 10, 1853. After graduating from the Stevens Institute of Technology in 1876, he entered railway service in the Baltimore, Md., shops of the Northern Central. He was assistant road foreman of engines of the Northern Central and Baltimore & Potomac, November, 1879, to December, 1881; assistant engineer of tests of the Pennsylvania Railroad at Altoona, Pa., December 1, 1881, to June 1, 1882; superintendent of motive power of the Northern Central, June 1, 1882, to June 1, 1883; superintendent of motive power of the Philadelphia, Wilmington & Baltimore, June 1, 1883, to June 1, 1890; superintendent of motive power of the Pennsylvania Railroad division of the Pennsylvania Railroad, June 1, 1890, to October 26, 1896; general superintendent of the Philadelphia & Erie and the Northern Central, October 26, 1896, to January 1, 1899; general superintendent of the Pennsylvania Railroad division of the Pennsylvania Railroad, January 1, 1899, to 1903. In 1903 Mr. Wallis retired from railway service, and in 1909 he went to the Safety Car Heating & Lighting Company as assistant to the president.

CATALOGS

Nut Tapping Machine.—The National Machinery Company, Tiffin, Ohio, has published a leaflet telling how its tapping machine will prevent the general breaking of taps.

Door Fixtures.—The Railway Utility Company, Chicago, has issued a new booklet describing its line of automatic locks for freight car doors, double roller door hangers, and other door fixtures.

Tool Steel.—The Tool Steel Gear & Pinion Company, Cincinnati, Ohio, has issued a small illustrated booklet containing service records for gears and pinions in use on a number of electric railways.

Wheel Presses.—The Watson-Stillman Company, New York, has published catalog No. 85, describing its hydro-pneumatic wheel presses. The catalog gives illustrations and detailed descriptions.

Hydro Recorders.—Herman Bacharach, Pittsburgh, Pa., has issued a series of pamphlets describing the various uses of hydro recorders. These instruments may be used for measuring draft, velocity, volume and pressure of air and water.

Water Flow Meters.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4941, which contains a description of the G-E water flow meters, and supersedes the bulletins heretofore published on this subject.

Machine Tools.—The Betts Machine Company, Wilmington, Del., has recently issued catalog No. 1R, illustrating various heavy horizontal and vertical boring mills, slotters and planers that have been installed in various railway and locomotive shops.

Car Roofing.—The Hutchins Car Roofing Company, Detroit, Mich., has issued a new illustrated catalog describing and illustrating both by detail drawings and photographs, its various types of outside metal roofs, inside all-metal roof, and plastic car roofing.

Hydraulic Benders.—The Watson-Stillman Company, New York, has recently issued catalog No. 83, containing 64 pages and describing its hydraulic machines. Special mention is made of the hydraulic benders, which are used for bending rails, rods, pipes, automobile frames, shafts, etc.

Electric Tools.—The Chicago Pneumatic Tool Company, Chicago, has issued bulletins E 19, E 20, E 21 and E 23, describing its Universal electric drill for direct or alternating current, a new line of electric drills for heavy duty, the Duntley electric track drill, and air-cooled direct current drills.

Recording Gage.—The Ashton Valve Company, Boston, Mass., has issued circular No. 50, describing its wheel press recording gage, duplex steam gage, triplex air gage, inspector's testing and proving outfit, locomotive gage cocks, train brake and signal cocks, test gages and pressure gage tester.

Liquid for Hydraulic Tools.—The Watson-Stillman Company, New York, has issued Bulletin J, which describes a new liquid, called Jackohol, for hydraulic tools. It does not thicken, freeze, gum or change in chemical composition and protects the metal surfaces and packings with which it comes in contact.

Equipment and Supplies.—The Walter A. Zelnicker Supply Company, St. Louis, Mo., has published in a small booklet a list of its new and second-hand equipment and supplies, including locomotives, cars, contractors' supplies, track supplies, dredges, derricks, pumps, scales, engines, hoists, steam shovels, etc.

Car Ventilation.—The Railway Utility Company, Chicago, has issued a small folder describing the Utility car ventilator, which is operated by a jet action caused by a downward rush of air between the body of the ventilator and an outer ring which siphons air from the interior of the car through an inner ring.

Elastic Corrugated Tubes.—O. N. Beck. 11 Queen Victoria street, London, E. C., has issued a catalog on the elastic corrugated tubes for expansion joints, heating and smoke tubes, superheaters, condensers, etc. These tubes have a uniform thickness throughout and will bend to a very small radius, and may be made to form most any connection.

Motors.—The General Electric Company, Schenectady, N. Y., has devoted bulletin No. 4915 to its type CVC, direct current motors of the commutating pole design. These motors embody certain improvements over those described in the company's previous bulletin on this subject. The bulletin amply illustrates and describes the motors and includes rating tables.

Metallic Hose Joints.—The Greenlaw Manufacturing Company, Boston, Mass., has issued catalog describing its flexible metallic joints. These joints will swing 50 deg. in any direction and are found to be especially useful for hose lines between cars and between the engine and tender; also for blower apparatus in engine houses. They are constructed for 200 lbs. pressure.

Scully Blue Book.—The Scully Steel & Iron Company, Chicago, has recently issued its 1912 "Blue Book," which is a very complete catalog of its stock with the list prices. This book is intended to take the place of the monthly stock list recently issued by this company, and besides covering its products has tables and information which will be found valuable to its customers.

Smokeless Chimneys.—The Furnace Gas Consumer Company, Matteawan, N. Y., has issued a 12-page pamphlet describing the furnace gas consumer, a device consisting of a bank of fire clay tubes installed in the space back of the bridge wall and underneath the boiler. It is claimed that these tubes become white hot, and in that condition they serve to complete the combustion of gases.

Small Polyphase Motors.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4933, describing its small polyphase motors of riveted frame construction. These motors are for two and three-phase circuits and wound for 25, 40 and 60 cycles. They range from ¼ to 15 h. p. This bulletin describes both horizontal and vertical motors, and contains illustrations of various applications of the motors.

Files.—The Vixen Tool Company, Philadelphia, Pa., has issued Bulletins A, B and C describing the Vixen files. These have deep semi-circular teeth, so formed that they will give off filings which resemble the turnings from a lathe or milling machine. The semi-circular tooth prevents clogging. Different types of files are clearly described and illustrated in these bulletins. Bulletin C is a report of tests made on this file by the Franklin Institute.

Machinists' Tables.—The Pratt & Whitney Company, Hartford, Conn., has issued a folding cardboard table which is of special value to machinists, and when folded is 7 in. x 15 in. The following tables are presented: U. S. standard screw threads; table of drilling speeds; metric standard screw threads; standard dimensions of wrought iron welded tubes; pitch or angular diameters of hand taps, and the A. S. M. E. standard for machine screws.

Steam Chart.—The De Laval Steam Turbine Company, Trenton, N. J., has issued a Mollier diagram with a special scale that is used to facilitate the reading of the diagram. This scale has four sets of divisions by which the pounds of steam per horse power hour; the duty in million foot lbs. per thousand lbs. of steam; the velocity in feet per second, and the B. t. u.'s per lb. of fuel may be easily determined. Full directions are given on the back of the diagram for the use of the chart and the scale.